Truing the Red 7 count

by Conrad O. Membrino, January 2010

With thanks to ET Fan for his valuable guidance and assistance in his initial review of this paper.

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Arnold Snyder's Red 7 count has now been in use for over 20 years. However, previous assessments of the Red 7 and other unbalanced counts have been based purely on using just the running count. This paper will show that it is just as easy to true the Red 7 count as any balanced count and end up with a count which is both more powerful (see Exhibit D1) and has greater accuracy (see Exhibit E) than the Hi-Low. This paper is a refinement of a couple of other papers on Blackjack Forum On-Line based on simulation results of the Red 7 which suggested counts for betting and playing strategy deviation.[1]

This write-up is to be read along with the Exhibits listed in the Table of Contents above. I will be referring to those Exhibits throughout this paper. The reader who just wants to learn how to true the Red 7 count needs to only refer to Exhibits A through H5 and read the corresponding sections of this write-up for those Exhibits. The other Exhibits are mainly of interest to those interested in the theory and the details and proofs of the statements I made in this paper.

This procedure in this paper will allow the use of the Red 7 count with true count accuracy and without the need to do any division. Also any errors in the true count resulting from errors in estimating decks played are eliminated (for true count of 2) or greatly reduced (for true counts of 3, 4 or 5) as compared to what the errors would be in true count calculations for a balanced count resulting from similar errors in estimating decks played. The closer to the pivot point, the less sensitive the true count calculation is the errors in estimating decks played. In the case of the Red 7, the pivot is a true count of 2. Balanced counts also have a pivot point – the pivot point for balanced counts is a true count of zero. So the two advantages of the Red 7 over balanced counts for the shoe game are (1) no division is required[2] and (2) true counts of 2, 3, 4 and 5 are calculated with much greater precision as compared to the calculation of these same true counts if a balanced counting system were used. See Exhibit E for further details.

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[1] THE EASY RED 7 COUNT By Arnold Snyder © 1983, 2005 Arnold Snyder
http://www.blackjackforumonline.com/content/How%20toCount.htm
How to Compare Blackjack Card Counting Systems, with a Comparison of the Red 7, Hi-Lo, and KO Counts By Arnold Snyder (From Blackjack Forum Volume XIX #3, Fall 1999) © Blackjack Forum 1999
http://www.blackjackforumonline.com/content/battleofbabies.htm
Blackjack Attack, 3rd edition, Page 380: "I am not a fan of unbalanced counts. As you stray from the pivot point, you lose accuracy for bet estimation. There's no free lunch. Unbalanced counts are "easier" because you do not have to convert to a true count, but betting according to the running count can never be as accurate as betting with the true count".

[2] No division is required when using the Red 7 critical running count charts presented in Exhibits A and B. Although similar charts could be made for balanced counts, the balanced count charts would be both unwieldy and less precise than the Red 7 charts for true counts of 2, 3, 4 and 5 because the pivot of a balance count is a true count of zero as opposed to the Red 7's pivot of a true count of 2. Thus, for example, a Hi-Low chart for a true count 5 row would have, for the six deck game, entries of 20, 15, 10 for decks played 2, 3 and 4 respectively. This is to be compared with Red 7 true count 5 row 24, 21 and 18 for decks played 2, 3 and 4 respectively. The Red 7 true count 5 row decreases by 3 for each deck played whereas the Hi-Low would decrease by 5 per deck played making the Hi-Low more susceptible to errors in estimating decks played than the Red 7 for a true count of 5.

Exhibit A - Six Decks

The first page of Exhibit A shows a departure chart of when to stop back counting and move onto another table. The Optimal Departure Point (ODP) was taken from *Blackjack Attack, 3rd edition,* as a true count of -1.[3] The equivalent six deck Red 7 running counts for a true count of -1 are shown as -3, 0, 3 and 6 for one, two, three and four decks played, respectively. Thus if 2 decks have been played and the Red 7 count is less than zero, that means to stop back counting that table and move onto another table. There is also a chart giving the Red 7 running counts corresponding to true counts of 2, 3, 4 and 5 for 2, 3 and 4 decks played.

The suggested betting is one, two, three and four units at true counts of 2, 3, 4 and 5 respectively with 4 units being the maximum bet. This can be seen on the first chart on the left of Exhibit A. For betting, the chart is to be read down the "decks played" column. Thus if three decks have been played, the suggested bet is one, two, three and four units at Red 7 counts of 12, 15, 18 and 21 respectively.

Six Decks

*rc = 12 + (tc - 2) * dr*

	decks played			Suggested
true count	2	*3*	4	Units Bet
2	12	***12***	12	1
3	16	***15***	14	2
4	20	***18***	16	3
5	24	***21***	18	4 (max)

Read down Decks Played Column for betting

Six Decks

*rc = 12 + (tc - 2) * dr*

	decks played		
true count	2	*3*	4
2	12	***12***	12
3	16	***15***	14
4	20	***18***	16
5	24	***21***	18

Read across True Count Row for playing strategy variations

The playing strategy chart is the second chart shown on the right of Exhibit A. It is to be read across the "True Count" rows. This will be explained a little further down in this paper, but basically playing strategy departures are based on the true count index that you look up in the Table of True Count Indices for the current strategic decision to be made. What is needed is the Red 7 running count

[3] True count of -1 is close to the average ODP recommended for several different penetrations and conditions studied in Blackjack Attack, 3rd edition.

corresponding to a given True Count which you simply read across the given true count row until you get to the number of decks played where you pick out the Red 7 running count to use for your playing strategy departure. Notice that at the pivot point of a true count of 2, the Red 7 running count is 12 throughout the shoe, independent of decks played.

The second page of Exhibit A shows a Table of True Count Indices which are basically the same as the indices for the Hi-Low count.[4]

The third page of this Exhibit is the Red 7 Table of Indices Dealer Hitting soft 17 (H17) and no doubling after split (NDAS). Only selected situations were calculated where there was a difference in playing strategy between H17 and S17 and between DAS and NDAS. Refer to Exhibits G3 and H3 for more details.

The main differences with H17 are:

1 Double 10 v A DAS if Red 7 true count >= 3.
2 Double 11 v A and A8 v 6 (basic strategy).
3 Stand on hard 12 versus 6 if the Red 7 true count >= -3.
4 Stand on hard 15 versus Ace if the Red 7 true count >= 6.
5 Stand on hard 16 versus Ace if the Red 7 true count >= 4.
6 Hit soft 18 versus Ace.
7 Double A9 v 6 if Red 7 true count >= 4.
8 Split 9,9 v A DAS if Red 7 true count >= 2.
9 Late Surrender h15 v A (basic strategy).
10 Late Surrender h14 v A if Red 7 true count >= 4.

The main differences with NDAS are:

1 Split Twos against 4, 5, 6 and 7 only.
2 Splits Threes against 4, 5, 6 and 7 and split Threes against a 3 if Red 7 true count >= 5.
3 Split Sixes against 3, 4, 5 and 6 and split Sixes against a 2 if Red 7 true count >= 2.
4 Do NOT split Eights (stand on the hard 16) against a Ten if Red 7 true count >= 5.
5 Stand on Nines against Seven.
6 Split Nines against Ace, S17 at Red 7 true count >= 4.
7 Split Nines against Ace, H17 at Red 7 true count >= 3.

The fourth page of Exhibit A has a Table of Indices for Late Surrender. Also shown on this page are Red 7 running counts showing when to take insurance. Insurance is taken at Red 7 true count of 3 which

[4] Exhibit D2 shows a direct side by side comparison of the Hi-Low and Red 7 indices for playing strategy variations at true counts of 2, 3, 4 and 5. Exhibit K3 proves that infinite deck Indices are directly proportional to the Standard Deviation and inversely proportional to the Correlation Coefficient of the count. The Red 7's Standard Deviation is 2.4% more than the Hi-Low which results in the infinite deck Red 7 indices being 2.4% greater than the infinite deck Hi-Low indices. But the Correlation Coefficient of the Red 7 for a given situation is often greater than the Correlation Coefficient of the Hi-Low for that same situation which tends to cancel some of this increase in the Red 7 Index due to its higher Standard Deviation making the indices of the two counts almost equal.

corresponds to Red 7 running counts of 17, 16, 15, 14 and 13 for decks played of 1, 2, 3, 4 and 5 respectively.

The bottom of the fourth page of Exhibit A shows the full Table of Running Counts for decks played 1, 2, 3, 4 and 5. In other Exhibits I have shown just decks played 2, 3 and 4 to keep things simple and also because that is what will be used most of the time when playing the six deck game. The columns decks played 1 can easily be extrapolated from decks played 2 and decks played 5 can easily be extrapolated from decks played 4, if necessary. The table has two very simple patters and these two “building patterns” are shown on Page 4 of Exhibit A which I will explain next.

The fifth page of Exhibit A is labeled *How to use Table of Running Counts for Betting*. Bets are made by reading down the deck’s played column. The reader determines how many decks have been played and then merely reads down the corresponding decks played column to determine how much to bet. Thus, if two decks are played, the column shows Red 7 counts of 12, 16, 20 and 24. What that means is that 1 unit should be bet at Red 7 count of 12, two units at Red 7 count of 16, three units at Red 7 count of 20 and four units, which is the maximum suggested bet, at Red 7 counts of 24 or more. This can be refined by interpolation, if desired. Thus if two decks are played and the Red 7 running count is 18 then an interpolated bet may be placed. For two out of six decks played, a Red 7 count of 16 means 2 units bet (Red 7 true count of 3) and a Red 7 count of 20 means 3 units bet (Red 7 true count of 4). Thus if more precise betting is desired, a running count of 18 means 2.5 units bet (Red 7 true count of 3.5). Interpolation and Extrapolation of this Table of Running Counts is explained in more detail on the sixth page of this Exhibit.

The fifth page of Exhibit A also shows two different table building patterns to help in remembering the entries in the table. Either pattern can be used to construct the table. So use either or both patterns to help build the table if you are unsure of or have forgotten some entries. After using the table for a while, the pattern will become second nature and calculations will not even need to be done.

The sixth page of Exhibit A is labeled *How to use Table of Running Counts for Playing Strategy Variations*. Notice that this table is to be read across the “true count” rows for playing strategy departure decisions. The Index for each strategic decision is taken from the Table of True Count Indices on second page of Exhibit A, which, as was mentioned earlier in this paper, are basically the same as the Hi-Low indices. Three examples have been included on this page, which basically explain how to use this Exhibit. It should be noted that for Indices with a true count of 2, the corresponding Red 7 running count is 12 throughout the shoe and so the running count to compare the Red 7 count to for playing strategy departures is simply 12. Thus, for example, if you are deciding whether to double on hard 8 v 6, the index is 2 and that corresponds to a Red 7 count of 12, anywhere in the shoe. So double on hard 8 v 6 whenever Red 7 >= 12 for the six deck game.

The seventh and last page of Exhibit A is labeled *Interpolating between True Count Rows or Decks Played Columns, Extrapolating beyond given True Count Rows or Decks Played Columns.* The given running count table for Red 7 true counts of 2, 3, 4 and 5 and decks played 2, 3, and 4 should be sufficient for most situations, but if additional accuracy is desired, the running count table can be interpolated between true count rows or decks played columns or extrapolated beyond shown true count rows or decks played columns by using either of both Table Building Patterns shown earlier in this Exhibit. Examples of interpolation and extrapolation of the running count table are shown.

The bets of 1 to 4 units as described in this section are to be used with the appropriate bankroll shown below and described more fully in Exhibit F1c. The chart below is for a risk of ruin (chance of losing your entire bankroll before or at the end of the trip) of around 2.5%.

Assuming 25 hands played per hour, the hourly win rate is 1.2 units and the hourly standard deviation is 14 units. If μ(n) = expected win, in units, for "n" hours of play and σ(n) = standard deviation, in units, for "n" hours of play then μ(1) = 1.2, σ(1) = 14, μ(n) = n*μ(1), and σ(n) = SQRT(n)*σ(1). So the expected win and standard deviation for a day's (8 hours) play is μ(n) = n*μ(1) = 8*(1.2) ≈ 10 units and σ(8) = SQRT(8)*σ(1) = SQRT(8)*(14) ≈ 39 units. The values of μ and σ for other trip durations are calculated similarly. If B = Bankroll and R = risk of ruin, then R can be calculated given μ, σ and B.[5]

Suggested 2.5% Risk of Ruin Bankroll by Trip Duration						
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt						
Trip Duration	Hours Played	Hands Played	μ = Exp. Win	σ = Std Dev	σ / μ	Bankroll
Day	8	200	10	39	4.0	80
Weekend	20	500	24	62	2.5	120
1 week	40	1,000	48	87	1.8	160
2 weeks	80	2,000	97	123	1.3	200
1 month	160	4,000	194	174	0.9	240
2 months	320	8,000	388	247	0.6	280

μ(1) = 1.2, σ(1) = 13.8, μ(n) = n*μ(1), and σ(n) = SQRT(n)*σ(1) where n = hours played

Approximate Bankroll for 2.5%, 10% and 20% Risk of Ruin						
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt						
(1)	(2)	(3)	(4)	(5)	(6) = 67%*(5)	(7) = 50%*(5)
Trip Duration	Hours Played	Hands Played	P(Loss)	≈2.5%	≈10%	≈20%
Day	8	200	40%	80	53	40
Weekend	20	500	35%	120	80	60
1 week	40	1,000	29%	160	107	80
2 weeks	80	2,000	22%	200	133	100
1 month	160	4,000	13%	240	160	120
2 months	320	8,000	6%	280	187	140

Notice the P(Loss) column above. This column represents the probability that there will be a net loss at the end of the given trip. So for the one week trip, for example, the probability of having a loss at the

[5] Blackjack Forum, March 1994: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) where R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll, and N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

end of the trip is 29%. So 29% of the one week trips will result in a net loss at the end of the trip and correspondingly 71% of the one week trips will result in a net win at the end of the trip.

For the one to four betting schedule suggested in this paper, the bankroll required for risk of ruin of 2.5%, 5%, 10%, 15% and 20% is shown below.

Exact Bankroll by Risk of Ruin					
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt					
Trip Duration	2.5%	5%	10%	15%	20%
Day	79	69	57	49	44
Weekend	118	102	83	71	63
1 week	155	133	108	92	80
2 weeks	198	167	134	113	98
1 month	240	200	158	132	113
2 months	272	224	174	143	122

This exact risk for ruin bankroll can be approximated to a high degree of accuracy from the 2.5% risk of ruin bankroll column as shown below.

Approximate Bankroll by Risk of Ruin					
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt					
(1) Trip Duration	(2) 2.5%	(3) = Avg((2),(4)) 5%	(4) = 67% * (2) 10%	(5) = Avg((4),(6)) 15%	(6) = 50% * (2) 20%
Day	80	67	54	47	40
Weekend	120	100	80	70	60
1 week	160	134	107	94	80
2 weeks	200	167	134	117	100
1 month	240	200	161	140	120
2 months	280	234	188	164	140

The chart above is for 6 deck, 4.5 dealt risk of ruin (chance of losing your entire bankroll before or at the end of the trip) with spreading 1 to 4 units as suggested in this paper. The ≈2.5% recommended risk of ruin column should be memorized. Then the rest of the risk of ruin table can be quickly constructed.

The bankrolls above are expressed in units (number of minimum bets). Thus for a day trip the 2.5% risk of ruin bankroll is 80 units which are 80 minimum bets or 20 maximum bets since the maximum bet is 4 units. So a day player with a $25 unit bet (and a $100 maximum bet) should have a bankroll of $2,000.

The above risk of ruin chart assumes that the player does not change the size of his unit bet with changes in the size of his bankroll. The player continues to bet 1 to 4 units, with no change in the size of his unit bet, until either the end of the trip or until the player loses his entire bankroll. If upon losing half his bankroll, the player were instead to cut the size of his unit bet in half, then the probability of ruin would be significantly reduced from that shown in the chart above which assumes a constant unit bet size played throughout the duration of the entire trip.

More details on the derivation along with examples of the use of these Risks of Ruin for the six deck, 4.5 dealt game with the 1-4 betting spread recommended in this section can be found in Exhibit F1c.

The suggested one to four unit bets assumes that only one hand per round is being played. If two hands per round are being played, then each hand should be 75% of the amount suggested for a single hand.

If one hand is played, Exhibit F1c shows that the six deck, 4.5 dealt game with the 1-4 betting spread recommended in this paper has an average bet of 2.33 units per hand played and the average hourly win rate, assuming 25 hands played per hour, of 1.2 units.[6] If two hands are played per round, then each hand is played at 75% of the amount suggested for a single hand so the average amount bet on each hand is 75% * 2.33 units = 1.75 units. The total amount bet for the two hands is thus 3.5 units which is 150% of the average amount bet of 2.33 units for a single hand. The total amount bet in one hour if two hands are played is thus (3.5 units bet per round played) * (25 rounds played per hour) = 87.5 units bet per hour which translates into an average win of 2.1% * 87.5 units bet = 1.8 units won per hour. So the hourly win rate playing two hands per round is increased from 1.2 units per hour to 1.8 units per hour, a 150% hourly increase in amount won by playing two hands. To win an expected 1.8 units playing single hands, 37.5 hands would need to be played.[7] Thus playing two hands per round at 25 rounds per hour is equivalent to 37.5 single hands played per hour which is again a 150% increase in the rate of hands played and expected amount won per hour. So if possible, it is best to play two hands.

Also, in Exhibit F1c, the recommended betting schedule of 1-4 is compared with the traditional 1-12 betting schedule where one unit is bet at a true count of one. Both betting schedules have the same player's advantage of approximately 2.1% and if the unit bet of player 1-4 is set to equal 2.15 times the unit bet of player 1-12,[8] then both players would have the same hourly win rate and hourly standard deviation. So the 1-4 player is essentially equivalent to the 1-12 player but with only a 1-4 betting spread, player 1-4 is much less obvious to the casino as a counter than would be player 1-12.

Finally, it is important not to get overly confident during a winning session and to keep the win in perspective of just how bad things can actually get. A loss greater than or equal to two standard deviations below the expected win will occur approximately 2.3% of the time and a loss greater than or equal to three standard deviations below the expected win will occur approximately 0.13% of the time. Again, Exhibit F1c has the answer to these questions. For the 1-4 betting schedule suggested in this

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[6] The player's advantage is calculated as (amount won) / (amount bet). Here the amount won is 1.2 units per hour and the amount bet is (2.33 units bet per hand) * (25 hands per hour) = 58.25 units bet per hour. So the player's advantage is (1.2 units won) / (58.25 units bet) = 2.1% which is in agreement with other calculations of player's advantage for this 1-4 bet spread shown in Exhibit F1c.

[7] (37.5 hands played)*(2.33 units bet per hand)*(2.1% advantage) = 1.8 units won.

[8] For example, if player 1-12 was betting $25 to $300 then if player 1-4 were to bet $53.75 to $215, player 1-4 would have the same hourly win rate and hourly standard deviation as player 1-12. Of course, player 1-4 would have to round his bets to range from $50 to $200.

paper, if the maximum loss is taken as two standard deviations below the expected win, then the maximum loss will occur at approximately 3,500 hands played or 3.5 weeks and the loss will be 157 units. A losing streak can last as long as 13,000 hands played or approximately 3 months and 1 week before a net win is realized. If the maximum loss is taken as three standard deviations below the expected win, then the maximum loss will occur at approximately 7,500 hands played or 7.5 weeks and the loss will be 353 units. A losing streak can last as long as 29,000 hands played or 7 months, 1 week. Also, these maximum losses are measured at the *end* of the given number of hands being played. In the interim, before the end of the given number of hands played, the loss may very well be greater than the maximum losses mentioned above.

Given a bankroll for a 2.5% risk of ruin, if the unit bet size is doubled, the bankroll is effectively cut in half and the risk of ruin increases from 2.5% to around 20%. For example, if the initial unit size for a weekend trip were $25 then 120 units or $3,000 is needed for an approximate 2.5% risk of ruin. The expected win for the trip is 24 units at $25 a unit or $600. The player then decides that that he would like to double his expected win and so increases his unit bet size to $50. His expected win is now 24 units at $50 a unit or $1,200. But with a $50 unit bet size, a $3,000 bankroll is now only 60 units. A 20% risk of ruin for a weekend trip corresponds, using the approximate risk of ruin bankroll table, to a 60 unit bankroll. So a 60 unit bankroll has a risk of ruin of around 20%. Doubling the unit bet size doubles the expected win but increases the risk of ruin from 2.5% to over 20% in this situation!

The chart above can also be used to estimate the risk of ruin for a given bankroll and unit size. Suppose you are on a day trip and you have $1,500 to gamble with and there are only $25 tables available. Then your unit bet size must be $25 and your bankroll, at $25 a unit, is effectively 60 units. For a day trip, a 67 unit bankroll has a risk of ruin of 5% and a 54 unit bankroll has a risk of ruin of 10%. So the risk of ruin for a day trip with a 60 unit bankroll is between 5% and 10%.

As a final example, if a player is comfortable with losing his entire bankroll one out of every ten trips, on average, then the player is playing to a 10% risk of ruin. The player is planning a one week trip and will be playing the $25 tables so his unit bet is $25. The player wishes to know the size of his bankroll that he should bring on this trip. For a 2.5% risk of ruin, a week trip requires a bankroll of 160 units. So if the player were to play to a 2.5% risk of ruin, he would need a bankroll of 160 * $25 = $4,000. For a 10% risk of ruin, the bankroll required is (2/3) of the bankroll for a 2.5% risk of ruin. Thus the player needs to bring a bankroll of (2/3) * $4,000 ≈ $2,675. Notice that $2,675 at $25 a unit corresponds to 107 units which is in agreement with the one week row, 10% risk of ruin column in the approximate risk of ruin bankroll table shown above.

All of these risks of ruins, as stated previously, assume that the player does change the size of his unit bet as the size of his bankroll changes but the player continues to bet the same size unit bet until he either losses his entire bankroll of till his trip ends. If the player cut the size of his unit bet in half after losing half of his bankroll, for example, his risk of ruin would be substantially reduced. In the example above with the weekend player's $3,000 bankroll and $50 unit bet (so his bankroll is 60 units), here is how to calculate his risk of ruin if the player cuts size of his unit bet in half to $25 after losing $1,500 which is half his bankroll. The weekend player's chance of losing 30 units (half his 60 unit bankroll) at some point during the trip is 50.5% - this was calculated using the Risk of Ruin formula with B = 30 units, $\mu = \mu(20)$ and $\sigma = \sigma(20)$. After losing half the bankroll the player reduces his unit bet size to $25. The player's bankroll is now $1,500 and his unit bet size is $25 so his bankroll is now restored to 60 units where the unit size is now $25 instead of $50. But the player will not be playing 20 hours (weekend session) from this point but will be playing (20 – h) hours where h = hours into his playing session where player's bankroll and unit bet size was cut in half. Assuming h = 10, then the new parameters are B = 60 units (at $25 a unit) and $\mu = \mu(10)$ and $\sigma = \sigma(10)$. Plugging these values into the Risk of Ruin formula gives a risk of ruin of 11.3%. So the compound risk of ruin of first losing half the bankroll, cutting the bet in half and then losing the last half of the bankroll is 50.5% * 11.3% = 5.7%.

To reduce your risk of ruin, when losing, cut your maximum bet in half which effectively cuts your betting spread from one to four to one to two units. For example, if you lost two maximum bets in a row, cut your maximum bet from four units to two units.[9] Do not wait until half of your bankroll is lost before cutting your spread in half. Once you start winning again, you can restore the one to four betting spread.

A conservative player may wish to start out his trip with a maximum bet of two units, i.e. cap the maximum bet at 2 units instead of 4 units. Thus the player would bet one unit at Red 7 true count of 2 and two units at Red 7 true counts greater than or equal to 3. If the player is winning, then the player can increase his maximum bet to four units according to the original recommended betting schedule.

[9] Exhibit F1c shows the Risk of Ruin for Betting Schedule B*, 1-2 spread and Betting Schedule C, 1-4 spread. Betting Schedule B*'s 1-2 spread greatly reduces the risk of ruin as compared to Betting Schedule C's 1-4 spread. This shows why this procedure of cutting your spread from 1-4 to 1-2 during a losing streak works so well to minimize bankroll fluctuations and preserve your capital.

Exhibit B – Eight Decks

I included these exhibits for the eight deck game to complete my presentation. This is very similar to the six deck exhibits and the techniques are basically the same, so I will not go in detail on how to use these tables other than to point of the differences from the six deck tables. If you can use the six deck tables you can use these tables.

This first page of Exhibit B shows similar information corresponding to the first page of Exhibit A showed but for the eight deck game. Notice that the optimal departure points when back counting the eight deck game is now Red 7 running counts of -6, -3, 0, 3, 6 and 9 for corresponding decks played of 1, 2, 3, 4, 5 and 6. These Red 7 running counts correspond to a true count of -1 which is what is used to determine the optimal departure point, i.e. stop back counting and find another table when the true count is less than -1. It is interesting to note that halfway through the eight deck game, i.e. 4 out of 8 decks dealt, the optimal departure point is a Red 7 running count of 3. This is exactly the same as with the six deck game. In the six deck game, the Red 7 running count optimal departure points are -3, 0, 3 and 6 for decks played 1, 2, 3, and 4 respectively. So for the six deck game, when 3 out of 6 decks have been dealt, that is half of the six decks have been dealt, the optimal departure point is a Red 7 running count of 3. So this pattern between the optimal departure points for the six and eight deck games should make remembering these Red 7 departure numbers easier.

The bottom portion of the first page of Exhibit B shows the Red 7 running count tables for betting and for playing strategy variation. Notice that I have only decks played 2, 4 and 6 shown. I do not want to make the chart too cumbersome to remember. If Red 7 counts for other decks played are needed, they can easily be interpolated or extrapolated from these given decks played column. An important point to be made with the eight deck game is that in the first three decks being played nothing much happens. Just too many cards left in the shoe to be worthwhile. So my suggestion is when decks played is three or less, your maximum bet should be two units and the playing strategy variations should be limited to true counts less than or equal to three. For decks played three or less, do not make any strategy changes for true counts of 4 or greater. This has the added benefit of reducing the complexity of the charts. Note that "n/a" is written in the column decks played 2, true count rows 4 and 5. No need to put any entries there - you will not be making any strategy changes for true counts of 4 or 5 and your bets are capped at two units at a true count of 3 when decks played are less than three.

Eight Decks

	decks played			
true count	2	*4*	6	Suggested Units Bet
2	16	***16***	16	1
3	22	***20***	18	2
4	n/a	***24***	20	3
5	n/a	***28***	22	4 (max)

Read down Decks Played Column for betting

dp < 3: max bet = 2 units

Eight Decks

true count	*decks played* 2	4	6
2	16	***16***	16
3	22	***20***	18
4	n/a	***24***	20
5	n/a	***28***	22

Read across True Count Row for playing strategy variations

dp < 3: no playing strategy variations for tc > 3.

The Table of True Counts on the second page of Exhibit A for the six deck game may also be used for the eight deck game. They are basically the Hi-Low indices which are almost the same as the Red 7 indices.

The second page of Exhibit B shows *How to use the Table of Running Counts for Betting* and the third page of Exhibit B shows *How to use the Table of Running Counts for Playing Strategy Variations*. These are similar to the corresponding tables for the six deck game and the Exhibits basically explain themselves.

Exhibit C – Shifted Red 7 Running Count

The general formula for the Red 7 true count is:

tc = 2 + (rc – 2*n) / dr

tc = true count
rc = Red 7 running count
n = number or decks
dr = decks remaining

Let src = shifted running count = (rc - 2*n)

Then a simplified Red 7 true count formula is calculated by setting the variable src = (rc – 2*n) which gives the formulas:

tc = 2 + (src) / dr
src = (tc – 2) * dr

At the beginning of a shoe rc = 0 and so src = -2*n. So simply start the count at -2 times the number of decks. Using the above formulas a true count can be calculated for a given (src) or if a true count is desired, the (src) corresponding to a desired true count can be calculated. These formulas should be used for one and two deck games and may also be used for the six and eight deck games instead of the tables presented in Exhibits A and B earlier. Also, suggested units bet = (tc – 1) which makes the units bet approximately proportional to the total player advantage, betting and playing strategy combined, as shown in Exhibit F1. Since tc = 2 + (src / dr) this means suggested units bet = 1 + (src/dr) as shown below.

Units Bet = (tc - 1)	
True Count	Units Bet
2	1
3	2
4	3
5	4
Units Bet = 1 + (src/dr)	

Referring to the table below, you can see the Red 7 shifted running count for a given true count.

src = rc - 2*n	
tc = 2 + (src) / dr	
src = (tc - 2) * dr	
tc	src
-1	- 3*dr
0	- 2*dr
1	- dr
2	0
3	dr
4	2*dr
5	3*dr
6	4*dr

Suppose you are in a six deck game and the situation is doubling A8 v 3 with two decks played, i.e. dp = 2 and so dr = 4. In the six deck game, n = 6 and src = rc – 12. The starting (shifted) running count at the beginning of the shoe, (src), using this technique, was -2*n = -12. The Red 7 index for doubling A8 v 3 is a true count of 5. And so the shifted running count corresponding to a true count of 5 is (src) = (tc – 2)*dr = (5 – 2)*dr = 3*dr which formula may also be pulled off directly from the table above for true count of 5. With dp = 2 then dr = 4 and src = 3*4 = 12. So double A8 v 3, 2 decks played if src >= 3*dr = 3*(6-2) = 3*4 = 12. This can also be seen in the Shifted Red 7 running count table below.

Six Decks

Shifted Red 7 running count

*src = (tc - 2) * dr*

decks played

true count	2	*3*	4	**src**
2	0	***0***	0	0
3	4	***3***	2	dr
4	8	***6***	4	2*dr
5	12	***9***	6	3*dr

Read across True Count Row for playing strategy variations

Notice that src = rc – 12 for the six deck game and so rc = src + 12 and so if src = 12 this corresponds to rc = 24. The chart in Exhibit A shows that the Red 7 count corresponding to a true count of 5 when decks played is 2 (i.e. decks remaining is 4) is 24. So both rules give the same result. Exhibit A says 2 out of 6 decks played double A8 v 3 when Red 7 >= 24 which is a true count of 5. And the shifted running count rule says double A8 v 3 when Shifted Red 7 = src >= 3 * dr = 3 * 4 = 12. If Red 7 = 24 then for the six deck game, src = rc – 12, so src = 24 – 12 = 12, which gives exactly the same results for Red 7 count using the tables in Exhibit A and the (src) using the (src) formula above.

Below is a summary of the shifted Red 7 running count. The betting strategy outlined below assumes back counting and so playing only for Red 7 true counts greater than or equal to 2:

src = Shifted Red 7 Running Count
src = rc - 2*n
src = (tc - 2) * dr
tc = 2 + src/dr
units bet = (tc - 1) = 1 + src/dr

The Shifted Red 7 running count is started at -2*n at the beginning of the shoe, where n = number of decks. Units bet is one plus the shifted running count divided by decks remaining, i.e. units bet = 1 + src/dr, as shown above. And if a playing strategy variation has a true count index of "Idx", then the strategy change is made if the shifted running count is greater than or equal to the (index minus two) times the decks remaining, i.e., if src >= (Idx – 2)*dr, then make the playing strategy change, or if the (6mAc) side count is kept, strategy change is made if (src + k*(6mAc)) >= (Idx – 2)*dr, where "k" is a constant which varies by playing strategy situation and "Idx" varies with "k".[10]

Alternately, as shown below, if tsrc (true shifted running count) is defined as (src/dr), i.e. tsrc = (src/dr), then tc = 2 + tsrc and units bet = 1 + tsrc. This calculated "tc" can be compared to the index to determine playing strategy variations.[11] This second procedure is mathematically equivalent to the first procedure[12] but is more complicated and involves more calculations than the first method above. *This second procedure has been listed here for the sake of completeness and is not recommended.*

tsrc = True Shifted Red 7 Running Count
src = rc - 2*n
tsrc = src/dr
tc = 2 + tsrc
units bet = (tc - 1) = 1 + tsrc

The recommended betting procedure outlined above is for back counted games only. To summarize the six deck back counted game:

[10] The Six minus Ace, (6mAc), side count is covered in the next section. If the (6mAc) is kept, then (src + k*(6mAc)) should be used wherever (src) appears in the above formulas and the playing strategy index used should be the Red 7 + k*(6mAc) index. So the strategy change is made if (src + k*(6mAc)) >= (Idx – 2)*dr, where "k" is a constant which varies by playing strategy situation. For example, for hard 16 against a T, k = -2 and Idx = 0, so stand if src – 2*(6mAc) >= -2*dr, otherwise, hit.

[11] For example, for hard 16 against a nine, k = -2 and Idx = 3. True shifted running count, tsrc, is calculated as tsrc = (src – 2*(6mAc))/dr and the true count is calculated as tc = 2 + tsrc. So stand on hard 16 against a nine if tc >= 3 means stand on hard 16 against a nine if 2 + (src – 2*(6mAc))/dr >= 3. This is equivalent to the playing strategy change rule of the first procedure, (src + k*(6mAc)) >= (Idx – 2)*dr, with k = -2 and Idx = 3.

[12] This second procedure says that playing strategy variation is made if tc >= Idx where tc = 2 + tsrc. But tc >= Idx implies 2 + (src + k*(6mAc))/dr >= Idx which is equivalent to (src + k*(6mAc)) >= (Idx - 2)*dr which is the result from the first procedure above. If no (6mAc) side count is kept, then k = 0 and so if src >= (Idx – 2)*dr then the playing strategy variation is made.

Six or Eight Deck back counted game:
src = rc - 2*n, tc = 2 + (src/dr)
Units bet = 1 + src/dr
maximum bet = 4 units
Playing Strategy Change, no (6mAc) count, if:
src >= (IdxA - 2) * dr
Playing Strategy Change, with (6mAc) count, if:
(src + k*(6mAc)) >= (IdxB - 2) * dr
If $k \neq 0$ then IdxB is not necessarily equal to IdxA[13]

For the six and eight deck games, the shifted running count is an option to use instead of using the Red 7 directly with the tables of critical running counts shown in Exhibits A and B. For the two deck game, the construction of a table of critical running counts would be too cumbersome and clumsy and so for the two deck game, the shifted Red 7 count is the only practical choice.

With the two deck game there is no back counting and so every hand needs to be played. A one to six bet spread is required to beat this game and the recommended units bet, to make up for playing at negative expectations, is twice the recommended back count betting, i.e. recommended units bet is two times (true count minus one). If decks played are greater than one, the floating advantage[14] should be taken into account and the true count betting formula, derived in Exhibit C, is a bit more complicated. Playing strategy variations are still made when src >= (Idx – 2)*dr, or if the (6mAc) is used, when (src + k*(6mAc)) >= (Idx – 2)*dr**,** just the betting schedule is changed.

Two Deck suggested betting
src = rc – 4, tc = 2 + (src/dr)
<u>0 < dp < 1:</u>
units bet = 2*(tc - 1), max bet = 6
<u>1 < dp < 1.5: (floating advantage)</u>
units bet = 1.35*tc + 0.625, max bet = 6

With the two deck game using the Shifted Red 7 running count, the count is started at -4 at the beginning of the shoe. A chart towards the end of Exhibit C shows that the above suggested betting rule is very closely approximated by the simplified rule below which does not involve any division.

[13] *Exhibit K3:* In the infinite deck case, Idx = k*(SD/CC) so IdxB/IdxA = (SD:B/CC:B)/(SD:A/CC:A) = (SD:B/SD:A)/(CC:B/CC:A) and IdxB and IdxA would be equal only if the ratio of the standard deviations between the two counts were equal to the ratio of the correlation coefficients between the two counts for the particular playing strategy variation being considered. *Exhibit C* shows a few examples where the indices are almost equal.

[14] Blackjack Forum, March 1989: The Floating Advantage.

Two Deck approximate betting
src = rc – 4, tc = 2 + (src/dr)
0 < dp < 1:
units bet = 2 + src, max bet = 6
1 < dp < 1.5: (floating advantage)
units bet = 3 + src, max bet = 6

If decks played less than one, then one unit is bet when src < 0 and bets start to increase for src >= 0. If decks played greater than one, one unit is bet when src < -1 and bets start to increase when src >= -1.[15]

This approximation to the suggested betting rule has the advantage of being easier to use than the suggested betting rule and similar to the suggested betting rule, caps the maximum bet at six units. So for the two deck, play all, one and a half decks dealt, one to six bet spread game the approximate units to bet is two plus the shifted running count, i.e. units bet = src + 2, if decks played is less than one and units bet = src + 3 if decks played is greater than one.

To summarize the two deck play all game:

Two Deck play all game:	
src = rc - 4, tc + 2 + (src/dr)	
0 < dp < 1:	units bet = 2 + src, max bet = 6
1 < dp < 1.5:	units bet = 3 + src, max bet = 6
Playing Strategy Change, no (6mAc) count, if:	
	src >= (IdxA - 2) * dr
Playing Strategy Change, with (6mAc) count, if:	
	(src + k*(6mAc)) >= (IdxB - 2) * dr
If $k \neq 0$ then IdxB is not necessarily equal to IdxA	

The (6mAc) side count is covered in the *Red 7 + k*(6mAc)* paper. For the six deck back counted game, four and a half decks dealt, one to four bet spread, the increase in expectation from insurance is 0.02% and the increase in expectation from all four hard 16 against 7, 8, 9 and T strategy changes combined is also around 0.02% for a total increase in expectation of 0.04%. If the Over 13 bet is not offered, the increase in expectation of the six deck game from using the (6mAc) side count is negligible and the main reason for using the (6mAc) side count is to reduce bankroll fluctuations and for casino camouflage.

Exhibit K15 of the *Red 7 + k*(6mAc)* paper calculates the *two deck* additional gain with the (6mAc) incorporated with the Red 7 count for insurance. Comparing the *Red 7 + k*(6mAc)* paper's Exhibit K15 with Exhibit K11d which is the six deck insurance additional gain, both the two deck and six deck gains

[15] True count = 2 + (src/dr). The average decks played in the interval 1.0 < dp < 1.5 is dp = 1.25 and so dr = 0.75. So the average true count in the interval 1.0 < dp < 1.5 when src = -1 is tc.average = 2 + (-1/0.75) = 0.67 which is in agreement with the floating advantage which states that deep in the shoe, true counts between zero and one have a positive player expectation.

are around 0.02%. This two deck additional insurance gain indicates that additional gains for other strategy changes *probably* vary very little by the number of decks so the two deck and six deck overall additional gain from including the (6mAc) with the Red 7 count are approximately equal.[16]

[16] For the two deck game, overall gain from hard 16 against a T may be greater than the indicated overall gain for the six deck back counted game since the index for this strategy change is zero and the two deck game is played through all true counts. Also additional gains from including the (6mAc) with negative indices may also increase the overall two deck advantage. Finally, the *7 unbalanced count* discussed in *Section 6* of the *Red 7 + k*(6mAc)* paper *may* be worthwhile to use with the two deck game.

Exhibit D1: Comparison of Infinite Deck Correlation Coefficients of Hi-Low and Red 7

This Exhibit shows a side by side comparison of infinite deck Correlation Coefficients of the Hi-Low and Red 7 counts, for strategic situations for true counts 2, 3, 4 and 5. Correlation Coefficients are weighted by total units bet near the playing strategy departure index. If the true count is significantly different from the index, both counts will yield the same decision. Differences in playing strategy decisions will occur close to the index and that is where the count with the higher Correlation Coefficient will give the best decision.

The number of units bet around the playing strategy index is calculated as follows. Column (3) of the chart in Exhibit D1 shows the Infinite Deck Hi-Low playing strategy index for each given situation. The initial number of units bet is shown in column (4) and is calculated as the Index in column (3) minus 1 since the betting system used is to be (tc – 1) units at a true count of "t" where "t" is greater than or equal to 2. Then doubling or splitting is taken into account in column (5). If the playing strategy decision is a double or split, then the units bet in column (4) is doubled in column (5). Column (6) takes into account the Hand Frequency per 100,000 hands of the given situation as shown in Table 7.1 of Blackjack Attack, 3rd edition. Then Column (7) rounds down the index in Column (3) subject to the index being greater than or equal to 2 since the shoe game is back counted. Column (8) shows the percentage of hands played at true count near the index using the 4.5 out of 6 decks dealt Hi-Low true count distribution. The hand frequency near the playing strategy index is next calculated as column (6) time column (8), i.e. the hand frequency near the index is the total hand frequency of that situation, column (6), times the true count frequency near the index, column (8). Finally, the total units bet near the index is calculated as the units bets close to the index, doubling and splitting taken into account, column (5), times the hand frequency at the true count close to the index, column (9). The result is column (10) which is the total units bet close to the index. Then the judgmental weights for each playing strategy variation if finally calculated in column (11) by taking the total units bet at each situation in column (10) divided by the total of column (10) which is all units bet close to the playing strategy indices. Using these weights with the corresponding Infinite deck Correlation Coefficient for each situation gives the weighted playing strategy index for the given count. And the weights for playing and betting combined is calculated in column (12) where the Correlation Coefficient for betting is given 50% weight and the Correlation Coefficient for playing strategy variations are reduced proportionally so that the total weights of playing and betting strategies combined equals 100%. Column (12) is used to calculate the playing and betting combined weighted correlation coefficient for each count.

The final results of these calculations can be seen in the average lines for columns (1) and (2) at the bottom of this chart. The summary of these averages are shown below.

	(1)	(2)
	Infinite Deck Correlation Coefficients (CC)	
Situation	Red 7	Hi-Low
betting, S17, DAS, no LS	96.8%	96.5%
Insurance	77.1%	76.0%
Avg #1: Play Only	**76.0%**	**75.1%**
Avg #2: Betting & Play	**86.4%**	**85.8%**

So for playing only the Red 7 weighted correlation coefficients are 76.0% versus 75.1% for the Hi-Low and for playing and betting combined the Red 7 was 86.4% versus 85.8% for the Hi-Low. This supports my earlier claim that the Red 7 is slightly more powerful than the Hi-Low.

Exhibit D2: Comparison of Hi-Low and Red 7 Indices

The tag values of the Red 7 count are the exact same tag values of the Hi-Low with the one exception that the Red 7 is also counted as +1 whereas the Hi-Low counts all sevens, eights and nines as zero. So, it would be reasonable to assume that the true count indices for departure from basic strategy should be fairly similar and that the Hi-Low indices can also be used, for he most part, for the Red 7 count. And this does indeed turn out to be the case, as can be seen from this Exhibit.

Exhibit D2 shows infinite deck Correlation Coefficients (CC), Average Advantage Change per True Count point (AACpTCp) and Indices for various strategic situations for the Hi-Low and Red 7 counts. These statistics were calculated in the Technical Section of this paper with specific reference to Exhibit K3 of the Technical Section which derives the relationship between Indices and AACpTCp of various counts and CC and SD (Standard Deviation) of those counts. The interested reader can refer to the Technical Section for more details and derivations. Suffice it to say here, for a given strategic situation, as the SD increases the index increases and as the CC increases the index decreases.

In the case of the Hi-Low and the Red 7 counts, they are both level one counts with the Red 7 counting one addition card, the Red 7, than then Hi-Low count. This leads to the Red 7 having a slightly larger SD than the High-Low count. It turns out that the SD of the Red 7 is actually 2.4% larger than the standard deviation of the Hi-Low. This, by itself, would lead to the Red 7 indices being 2.4% larger than the Hi-Low indices. However, the CC must also be taken into account and for most strategic situations the CC is slightly larger for the Red 7 than the Hi-Low. Since the index decreases as the CC increases, this increase in the CC negates, totally cancels or may actually reverse the increase in the index due to the larger SD of the Red 7. For the few situations where the CC of the Red 7 actually is less than the CC of the Hi-Low, the CC and the SD both work the increase the Red 7 index. This can be seen in last example of Exhibit K3, which is splitting tens against a five. In this case, the infinite deck Hi-Low index is 5.09 and the infinite deck Red 7 index is 5.29. This is because the infinite deck CC of the Red 7 for this situation is less than the CC of the Hi-Low and of course, the Red 7 also has a larger standard deviation than the Hi-Low.

So for the most part, the Red 7 and the Hi-Low indices are very similar and since the indices are rounded to the nearest integer, the Hi-Low indices can basically be used with the Red 7 so there is no need to learn new indices for the Red 7 count. This can be seen by comparing the infinite deck index columns of the Hi-Low and Red 7 in this Exhibit.

Exhibit E:
Sensitivity of Red 7 True Count to Errors in Estimating Decks Played for True Counts of 2, 3, 4 and 5

The pivot point of the Red 7 is a true count of 2. The closer to the pivot point, the less any errors in estimating decks played will have on the calculation of the true count. At the pivot point itself, the true count is independent of the decks played. For a balanced count, the pivot point is a true count of zero. For the Red 7, the pivot point is a true count of 2, as mentioned above. When back counting the shoe, true counts of 2, 3, 4 and 5 are of primary concern and the accurate calculation of these true counts is very important for both accurate betting and playing strategy variations.

Since the pivot point of the Hi-Low is a true count of zero, the Hi-Low pivot is much farther removed from true counts of 2, 3, 4 and 5 than the Red 7 which has a pivot point of 2, if a player made similar errors in estimating decks played for the Hi-Low and the Red 7, the Hi-Low true count errors resulting from errors in estimating decks played are amplified for true counts of 2, 3, 4 and 5 as compared to equivalent errors in estimating decks played if using the Red 7 count as is shown in this Exhibit.

Exhibit E is labeled as *Sensitivity of the Red 7 True Count to Errors in Estimating Decks Played for True Counts of 2, 3, 4 and 5.* This Exhibit assumes a six deck game. Column (1) of Exhibit E shows the actual decks played. The estimated decks played are shown in column (2) and were overestimated, on average, by 0.75 decks. Column (3) is actual decks remaining calculated as 6.0 – column (1), actual decks played. Column (4) is estimated decks remaining calculated as 6.0 – column (2), estimated decks played. Column (5) is the Hi-Low running count. Column (6) is what the corresponding Red 7 running count would most likely be, calculated as the Hi-Low count, column (5) + twice the actual number of decks played, column (1), since two sevens are expected per deck played, on average. This calculation often results in a fractional value for the most likely Red 7 count. Since the Red 7 count must be an integer, the result from the calculation shown is rounded to the closest integer. Column (7) is the actual Hi-Low true count, calculated as Hi-Low running count, column (5), divided by actual decks remaining, column (3). Column (8) is the estimated Hi-Low true count calculated as the Hi-Low running count, column (5) divided by the estimated decks remaining, column (4). Column (9) is the actual Red 7 true count, calculated as 2 + (Red 7 running count, column (6) minus 12) divided by (actual decks remaining, column (3)). Column (10) is the estimated Red 7 true count, calculated as 2 + (Red 7 running count, column (6) minus 12) divided by (estimated decks remaining, column (4)). The final results can be seen in columns (11) and (12) of Exhibit E where the absolute value of the errors of the calculated from actual true counts for both the Hi-Low and the Red 7 counts. These errors were tabulated for a multitude of various situations for true counts of 2, 3, 4 and 5. The overall result of all of these situations was the Red 7 had an average true count error of 0.64 as compared to the Hi-Low which had an average true count error of 1.33 as can be seen in the Overall Average bottom row for columns (11) and (12). So for true counts of 2, 3, 4 and 5, the Red 7 had less than half the error in the resulting true count calculations as did the Hi-Low resulting from identical errors in estimating decks played. And this just tested for errors in estimating decks played. The Hi-Low is also subject to division and rounding errors as well, which the Red 7, with its table lookup of critical running counts by true count and decks played, is not subject to these errors. So the Red 7 is more accurate than the Hi-Low in calculating true counts of 2, 3, 4 and 5.

When choosing a counting system, four criteria should be analyzed and weighed: (1) Power, (2) Accuracy, (3) Simplicity, and (4) Speed. The Red 7 is slightly more powerful (as measured by correlation coefficients for betting, insurance and playing strategy variations) than the Hi-Low.[17]

Accuracy, criteria (2) above, I define as how close the player can estimate the true count to the actual true count. The accuracy of the Red 7 for true counts of 2, 3, 4 and 5 greatly exceeds the accuracy of the Hi-Low for those same true counts as shown in this Exhibit. The importance of an accurate true count cannot be overemphasized. An accurate true count is necessary for proper betting (see Exhibit F1), insurance and playing strategy variations (see Exhibit F2). The Hi-Low has three true count sources of error (1) errors in estimating decks played, (2) division errors in dividing the Hi-Low count by the estimated decks remaining and (3) rounding errors in rounding the resulting quotient to the nearest true count. Exhibit E explained above addressed only the errors in the true count caused by errors in estimating decks played and showed the greater accuracy of the Red 7 over the Hi-Low for true counts 2, 3, 4 and 5. Although not absolutely necessary for Red 7 true counts of 3, 4 and 5, if additional accuracy is desired in, the critical running count table can be interpolated or extrapolated as shown in Exhibit A shown earlier in this paper.

Simplicity is criteria (3) above. Both the Hi-Low and Red 7 are level one systems so they are both simple in that respect. However the Hi-Low requires accurate division and a much closer estimation of decks played to give the same level of true count accuracy as the Red 7 for true counts of 2, 3, 4 and 5. The Red 7, for true counts of 2, 3, 4 and 5, requires no division, no interpolation and estimation to the nearest full deck is more than sufficient. No division is required since the running count needed for playing or strategy changes can easily be looked up in the small tables included in Exhibits A and B of this write-up. If desired, the shifted Red 7 count method shown in Exhibit C may also be used may be used instead (where multiplication replaces division with the shifted running count compared to (tc-2)*(decks remaining) of the tables shown in Exhibits A and B – they give equivalent results as shown earlier in Exhibit C section of this paper. For true counts of 2, 3, 4 and 5 estimation to the nearest full deck is more than sufficient. As a matter of fact, for the six deck game, just using the three columns I have shown, are sufficient for extreme accuracy for true counts of 2, 3, 4 and 5. The column decks played 2 can be used for the first third of the shoe, the column decks played 3 for the middle of the shoe and the column decks played 4 for the final third of the shoe without any interpolation required and with minimal loss of accuracy.

Speed is the fourth and last criteria. Under casino conditions, a quick and accurate decision is needed. The Red 7 with a table look is very quick, as compared to the Hi-Low which requires division, rounding, and an accurate estimation of decks played necessary to get an accurate true count. So in addition to no division required (with the possible division and rounding errors) and errors in the true count resulting from errors in estimating decks played minimized or reduced, the Red 7 with the table lookup has the additional advantage of speed. In a casino, you need to make your decisions quickly and accurately. So,

[17] Exhibit D1 above shows true counts 2, 3, 4 and 5 weighted average Correlation Coefficient for playing only of 75.1% for the Hi-Low versus 76.0% for the Red 7 and for playing and betting combined 85.8% for the Hi-Low versus 86.4% for the Red 7.

for example, suppose the player has a hard 15 against the dealer's T up card. Here is how quickly the decision can be made with the Red 7 for the six deck game. Player knows index for h 15 versus T is a true count of 4. The six deck true count 4 row: 20, 18 and 16 for decks played 2, 3 and 4 respectively. The player realizes that he is halfway through the shoe and so uses the decks played 3 critical running count of 18 from the true count 4 row: 20, 18 and 16. So the player asks the question, is the current Red 7 count greater than 18? If so then the player stands, otherwise he hits. This decision can be made in a second or two without having to stop to try to ascertain decks played to the nearest half deck, calculating the true count with a division and then possible rounding errors with the resulting calculated Hi-Low true count still not as accurate as the Red 7 true count with table look up. All of these comments above pertain to true counts of 2, 3, 4 or 5 in a six or eight deck game.

In summary, the Red 7 has all of the desirable characteristics that a good count should have. It is (1) powerful, coming in slightly more powerful than the Hi-Low, (2) accurate, where the error in true count calculations for true counts 2, 3, 4 and 5 resulting from errors in estimating decks played is either eliminated or greatly reduced and is not subject to division or rounding errors either, (3) simple, in that in addition to being a level one count, no division is required, no interpolation and estimation to the nearest full deck is more than sufficient, and (4) speedy in that a quick and accurate decisions can be made by simply comparing the Red 7 count to the critical running count from the Red 7 table lookup corresponding to the given true count and decks played.

Exhibit F1a: Accuracy of Red 7 True Count for Betting

Proper betting requires that the amount bet should be directly proportional to the player's advantage. Exhibit F1a calculates the total player's advantage at true count "t" (tpa(t)) for Red 7 counts of 2, 3, 4, 5 and 6 which consists of two components (1) betting player's advantage at true count "t": ba(t) = AACpTCp * (t –Idx) = 0.495% * (t – 0.81) and (2) strategy gain at true count "t" (sg(t)) which is calculated as a weighted average in the strategy gains for each situation in the table given in this Exhibit. The result is shown in the bottom of this Exhibit.

Total Player's Advantage at true count "t"	=	tpa(t) = ba(t) + sg(t)
Betting Advantage at true count "t"	=	ba(t) = AACpTCp * (t - idx)
Strategy Gain at true count "t"	=	sg(t) = taken from weighted average table
Suggested units Bet at true count (t)	=	sb(t)

Suggested Bet directly proportional to total player's advantage

true count	ba(t)	sg(t)	tpa(t)	tpa(t) / tpa(2)	suggested bet
2	0.59%	0.07%	0.66%	1.00	1
3	1.08%	0.13%	1.21%	1.83	2
4	1.58%	0.32%	1.90%	2.87	3
5	2.07%	0.64%	2.71%	4.09	4 (max)
6	2.57%	1.02%	3.59%	5.41	4 (max)

*Note: sb(t) ≈ sb(2) * { tpa(t) / tpa(2) }*

So with the suggested betting schedule of 1, 2, 3 and 4 units at true counts 2, 3, 4 and 5, the suggested bets at each true count are approximately directly proportional to the increase in the player's advantage for each at each of these true counts.

The bottom of this Exhibit shows the pa(t) for Betting, S17, DAS, no LS and for Betting, H17, DAS, no LS. It can be seen the H17 starts out at true count zero with a FDHA of 0.62% and S17 starts out with a FDHA of 0.40%. But the AACpTCp for H17 is 0.514% whereas S17 has an AACpTCp of 0.495%. so at a true count of zero, H17 is 0.22% less player advantageous than S17. However, the extra AACpTCp of H17 over S17 results in closing the player's advantage gap as the true count increases so that at true count of 6, the H17 is only 0.10% less advantageous than S17. As the true count increases, if the playing strategy gain obtained from H17 strategy changes is greater than the strategy gains from S17 strategy changes, this would close the gap, for high true counts, between H17 and S17 *overall* advantage even further.

Exhibit F1b: Extrapolated Average Player's Advantage

In the Red 7 + k*(6mAc) paper, a simulation of 500 six deck shoes, 4.5 decks dealt, truncated distribution where Red 7 true count >= 2, was run and the percentage of hands at each Red 7 true count were tabulated for true counts 2, 3, 4, 5, 6, 7 and 8. The percentage of hands for each Red 7 true count was extrapolated up to Red 7 true count of 12 and then the average player's advantage was tabulated using the total player's advantage gain calculated in Exhibit F1a.

Exhibit F1c – Analysis of Various Betting Schedules

This section compares the suggested betting in this paper to several other betting schedules, some of which are shown below.

Six Decks, 4.5 Decks Dealt

Red 7 True Count >= -1

Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet					
Red 7 "tc"	total adv	A	B	C	D	E	F
-1	-0.90%	0	0	0	0	0	0
0	-0.40%	0	0	0	0	0	0
1	0.09%	0	0	0	0	0	0
2	0.66%	1	1	1	1	1	0
3	1.21%	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4

Sch D: bet(t) = (tc - 1), no max

Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2)

Sch F: bet(t) = (tc - 2), max = 4

Exhibit H explains why the betting schedule suggested in this paper, betting schedule C, is the preferred betting schedule to use. With betting Schedule C the player advantage is 2.1%.[18]

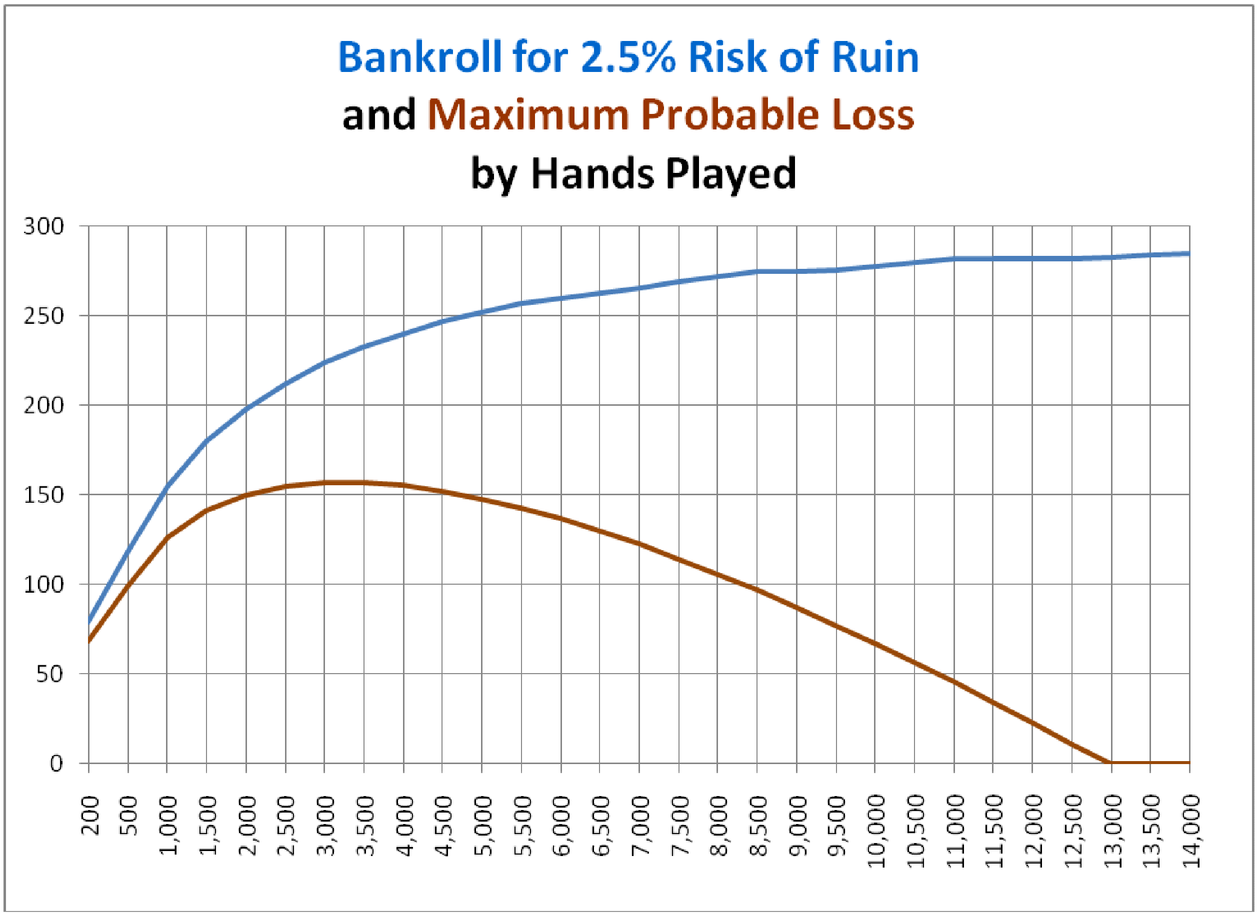
The chance of being two or more standard deviations below the mean, for the normal distribution, is 2.3%. Thus I defined the maximum probable loss, MPL, as two standard deviations below the expected win. The MPL is measured at the *end* of the given number of hands played, i.e. the chance of losing the MPL or more at the end of playing the given number or hands is 2.3%. During the play of the given number of hands, the loss may exceed the MPL. The risk of ruin bankroll takes this into account.

As the number of hands played increases, μ = expected win, increases proportional to the number of hands played, σ = standard deviation of expected win, increases proportional to the square root of the

[18] Schedule C' (shown in Exhibit F1c but not shown in chart above) is the same as Schedule C except that half unit bets were made at true counts between -1 and +1 which is used to approximate the situation where the player is not able to sit out all hands at true counts below 2. This results in the player advantage being reduced from 2.1% to 1.1% with a corresponding reduction in expected win, increase in standard deviation of expected win and increase in maximum probable loss and chance of being behind, P(Win <= 0), as compared to similar statistics from betting Schedule C where no bets are made at true counts below 2.

number of hands played and so (σ/µ) decreases proportional to the inverse of the square root of the number of hands played. Thus if the number of hands played quadruples, then µ quadruples, σ doubles and (σ/u) halves.

Bankroll for 2.5% Risk of Ruin, in Units
By Hands Played
Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5
Six Decks, 4.5 Decks Dealt



Above is a graph of the 2.5% Risk or Ruin Bankroll and the Maximum Probable Loss, ABS(µ – 2*σ), for the six deck game and betting schedule C. Reading from the graph, if 2,000 hands are played then a bankroll of 200 units is required for a 2.5% risk of ruin (losing the entire bankroll at some point during the trip) assuming that player does not reduce the size of his unit bet if he is losing.[19] And if played till

[19] If player loses half of his bankroll and then cuts his unit bet in half, he is essentially starting anew with the same number of (reduced size) units as he had in his original bankroll (in initial larger units) and the same 2.5% risk of ruin of ruin with his new reduced bankroll as he had with his initial bankroll. For example, suppose an 80 unit bankroll was taken for a day's play of 8 hours or 200 hands for a 2.5% risk of ruin. For 200 hands played, if the bankroll were 40 units instead of 80, then the risk of ruin rises from 2.5% to 23.3%. So during the play of the 200 hands, 23.3% of the time half of the 80 units will be lost at some point or other. So you would lose half of your original 80 unit bankroll 23.3% of the time. Your unit bet size is cut in half so your bankroll is restored to 80 units

the end of these 2,000 hands, the chance of losing more than the maximum probable loss of 150 units (which is two standard deviations below the expected win) is 2.3%. Assuming 25 hands played per hour, then 2,000 hands played would correspond to 80 hours of play which would be around two weeks of play assuming 40 hours of play per week. So assuming 200 hands in a day of play (8 hours), 500 in a weekend of play (20 hours), 1,000 in a week of play (40 hours) and 2,000 in two weeks (80 hours of play) then 80, 120, 160 and 200 units of bankroll would be required for a day, a weekend, a week and two weeks of play, respectively. In the chart below, each one thousand hands played can correspond to one week of blackjack play if it is assumed that a week of play consist of 40 hours of play and 25 hands are played per hour. Thus if a trip were to consist of 8 weeks of play that would correspond to 8,000 hands played which would require a 280 unit bankroll for a 2.5% risk of ruin.

The suggested bankroll requirements taken from the graph of Bankroll for 2.5% Risk of Ruin and Maximum Probable Loss by Hands Played can be summarized in the table below.

≈ 2.5% Risk of Ruin, 25 hands played/hour, 40 hours/week							
Hands Played	Hours Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss
200	8	Day	80	10	39	40%	68
500	20	Weekend	120	24	62	35%	99
1000	40	1 week	160	48	87	29%	126
2000	80	2 weeks	200	97	123	22%	150
4000	160	1 month	240	194	174	13%	155
8000	320	2 months	280	388	247	6%	106

Notice the P(Loss) column. Similar to MPL, this is the chance of being behind at the *end* of the given number of hands played. Thus for a one week trip (40 hours or 1,000 hands played), the chance of a loss at the *end* of the trip is 29%. So 29% of the one week trips will result in a loss and 71% of the one week trips will result in a win.

Using 8 weeks (320 hours or 8,000 hands played) as a base, the expected amount won for one hour of play (at 25 hands per hour) is (388 / 320) = 1.2 units won per hour played. Also σ(320) = SQRT(320)*σ(1) so the standard deviation for one hour of play is σ(1) = σ(320)/SQRT(320) = 247/SQRT(320) ≈ 13.8 units.

Example: Day trip playing $25 tables, so the unit bet size is $25. 80 units or $2,000 should be brought for this day trip for a 2.5% risk of ruin. If true count = 2, a one unit bet or $25 is justified on one hand or 75%*$25 ≈ $20 on each of two hands. Since table minimum is $25, then bet $25 on each of two hands. If true count = 3, then bet is two units or $50 on one hand or 75%*$50 ≈ $40 on each of two hands. If true count = 4, then bet is 3 units or $75 on one hand or 75%*$75 ≈ $60 on each of two hands. If true count >= 5, then bet is 4 units or $100 on one hand or 75%*$100 = $75 on each of two hands.

(where each new unit is one half of the original unit). Assuming the loss occurs halfway through your trip, you now have 4 hours remaining and an 80 unit bankroll so your risk of losing the 80 units in four hours is 0.22%. (B=80, μ(4) = 4*μ(1) = 4*(1.2), σ(4) = SQRT(4)*σ(1) = 2*(13.8) which gives R = 0.22%). The compound risk of ruin of first losing half your bankroll, cutting the unit bet in half, and then losing the rest of your bankroll, is 23.3% * 0.22% = 0.05%.

Here are a few more examples of use Bankroll by Trip Duration, for the $25 unit bet player.

Day Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
80	$25	$2,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$25	$3,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

One Week Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
160	$25	$4,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Two Weeks Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
200	$25	$5,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

One Month Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
240	$25	$6,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

If Weekend Trip player wanted to play two hands at $25, $50, $75 and $100 at the same 2.5% Risk of Ruin, then player would have to increase his bankroll 33% from $3,000 to $4,000. If player #1 played two hands at $25, $50, $75 and $100 his risk of ruin would increase to 8%. See Exhibit H for details.

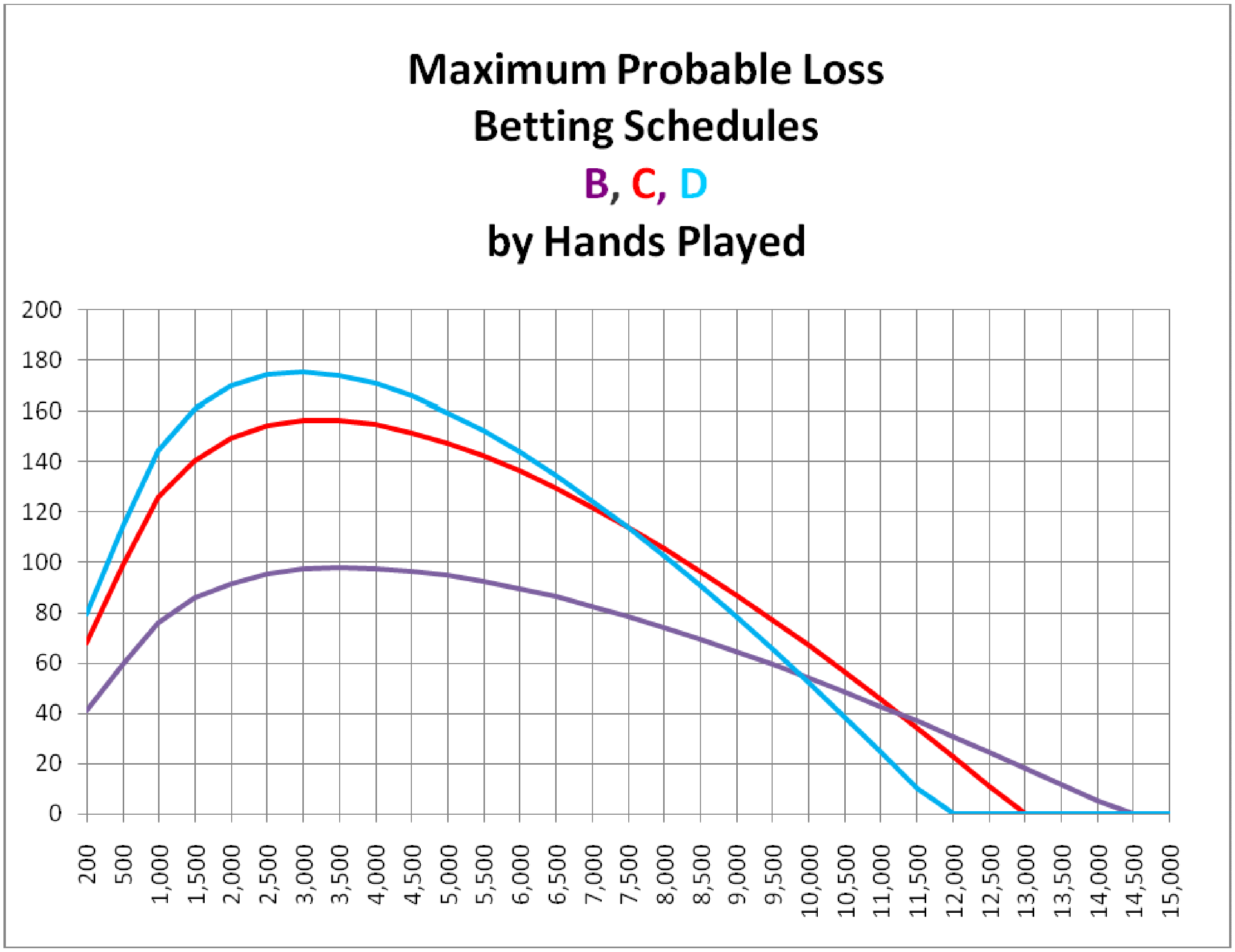
Player #1

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$25	$3,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Player #2 (Player #2 Bankroll) = (4/3) * (Player #1 Bankroll)

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$33	$4,000	1	$33	$67	$100	$133
		75%	2	$25	$50	$75	$100

Maximum Probable Loss (MPL)
MPL = ABS(μ - 2*σ) when (μ - 2*σ) < 0, otherwise MPL = 0
Six Decks, 4.5 Decks Dealt



Red 7 "tc"	B	C	D
2	1	1	1
3	1	2	2
4	2	3	3
5	2	4	4
6	2	4	5
7	2	4	6
8	2	4	7
9	2	4	8
10	2	4	9
% adv	1.8%	2.1%	2.3%

Above is a comparison of betting schedules B, C and D mentioned above. I defined the term MPL = maximum probable loss, to compare theses various betting schedules. MPL is ABS($\mu - 2*\sigma$) if ($\mu - 2*\sigma$) < 0 and MPL = 0 if ($\mu - 2*\sigma$) >= 0. MPL is thus two standard deviations below the expected win and so the probability that the win will be less than (-1)*MPL (a negative win is a loss) is approximately 2.3%. As explained earlier, the MPL is measured at the *end* of the given number of hands played, i.e. the chance of losing the MPL or more at the end of playing the given number or hands is 2.3%. During the play of the given number of hands, the loss may exceed the MPL.

If MPL is thought of as "risk" and if the long run is thought of as occurring when MPL = 0, then B has less risk initially than C but as hands played increases C has less risk than B. The MPL graph of C is above B (more risk) for hands played < 11,250 and C is below B (less risk) at hands played > 11,250. C hit the long run at 13,000 hands and B does not hit the long run until 14,500 hands. Likewise, D is initially more risky than C but at > 7,500 hands D is less risky than C and D reaches the long run at 12,000 hands as compared to C which takes 13,000 hands to reach the long run. B can be thought of as timid betting with 1.8% advantage, C is moderate betting with 2.1% advantage and D is aggressive betting with 2.3% advantage.

For Schedule C betting, the average units bet per hand is 2.33 and the player advantage is 2.1% so the average units won per hand is 2.33 * 2.1% = 0.048. If 25 hands are played per hour, then the average hourly win rate is (0.048 units won / hand) * (25 hands / hour) = 1.2 units won per hour.

A comparison of a 1-4 betting spread recommended in this article and a 1-12 betting spread commonly used by some professional players was also done. The 1-12 spread would draw more casino heat than the 1-4 spread and both give the same results. Below were the two betting schedules that were compared.

Betting Schedules		
Red 7 true count	1-12 spread Units Bet	1-4 spread Units Bet
1	1	0
2	2	1
3	3	2
4	4	3
5	9	4
6	12	4
7	12	4
8	12	4
9	12	4
10	12	4

The 1-12 betting schedule had a player advantage of 2.02% and the 1-4 betting schedule had a player advantage of 2.08%. Basically, both betting schedules had the same player advantage.

Comparison of Betting Schedules	1 to 12 spread	1 to 4 spread	1 to 4 with 115% increase in unit bet size
Player Advantage	2.02%	2.08%	2.08%
μ(1) = Expected Units Won per hour played	1.67	0.78	1.67
σ(1) = Std Dev per hour played	23.9	11.0	23.7
σ(1) / μ(1)	14.3	14.2	14.2

The 1-12 player made one unit bets at true counts of 1 while the 1-4 player made no bets at a true count of one with the 1-4 player's first bet coming in at a true count of 2. So if player 1-12 played 27 hands an hour player 1-4 was calculated to play only 16 hands an hour. This result was that player 1-4 won only 0.78 units per hour as compared to player 1-12 winning 1.67 units per hour. But the standard deviation of player 1-4 was only 11.0 as compared to player 1-12 which was 23.9. If the size of the unit bet of player 1-4 were increased 115% then the expected win per hour and the standard deviation per hour of both betting systems were essentially equal. This can be seen in the following example. If the unit bet of player 1-12 were $25 then player 1-12 would be betting $25 to $300. If the unit bet of player 1-4 were also $25 then player 1-4 would be betting $25 to $100. Of course, player 1-4 could not win as much per hour as player 1-12 since player 1-4 is betting less. If the unit bet of player 1-4 were increased by 115% placing the unit bet of player 1-4 at $53.75 then if player 1-4 ranged his bets from $53.75 to $215, player 1-4 would have, essentially, the same hourly earnings and standard deviation as player 1-12 but with only a one to four bet spread, player 1-4 would be less obvious to casino personnel as a counter than would player 1-12. Of course, player 1-4 could not bet $53.75 to $215 and would have to round his bets ranging from $50 to $200.

Exhibit F1d Red 7 and Hi-Low True Count Distributions

The Exhibit shows the Red 7 and Hi-Low True Count distributions from the simulation of 10,000 Six Deck, 4.5 decks dealt. The results were tabulated in true count intervals of 0.1 for maximum accuracy in the calculation of the mean, standard deviation, skew and kurtosis. Also, the true counts recorded extended from -17.5 to +17.5 capturing virtually the entire true count distributions. The result of the 10,000 Six Deck, 4.5 decks dealt simulation was almost 2,340,000 simulated hands for both the Red 7 and Hi-Low true counts.

The resulting true count mean of the Red 7 and Hi-Low was zero, as would be expected. This Exhibit also shows that true count calculated standard deviation of the Red 7 (2.4415) is 2.54% greater than the standard deviation of the Hi-Low true counts (2.3809) which is in good agreement with the theoretical ratios calculated in Exhibit K3 where the standard deviation of the Red 7 (0.8979) is 2.38% greater than the standard deviation of the Hi-Low (0.8771).

The Skew of the Red 7 and Hi-Low are both basically zero, i.e. the true count distributions are un-skewed, as would be expected. However, the Kurtosis of both the Red 7 and Hi-Low were both over 5.3. The Kurtosis of the normal distribution is 3 so both the Red 7 and Hi-Low true count distributions are significantly leptokurtic.[20] This means that the normal distribution approximation is not that good a fit for the Hi-Low and Red 7 true count distributions.

The integer interval mean, hand frequency and hand percentages for each Red 7 true count was also tabulated from this data. It is to be noted that within Red 7 true count intervals, the absolute value of the interval mean was less than the absolute value of the midpoint, which is in agreement with intuition since the true count distribution has a mean of zero with the hand frequencies falling off as the distance from zero increases. So, for example, for Red 7 true count 2, it can be seen that the interval mean is 1.9514. The Red true count 2 corresponds to the Red 7 true count interval [1.5,2.5) which has a midpoint of 2.0. So in this case, the interval mean, 1.9514, is less than the midpoint of the interval, 2.0. This Red 7 true count interval mean is used in *Exhibit K11p* of the *Red 7 + k*(6mAc)* paper to help reconcile remaining discrepancies between the simulated (6mAc) true count mean within each Red 7 true count interval and the theoretical (6mAc) true count mean.

Finally, Integer Red 7 true count percentages for True Counts greater than or equal to two were calculated from this data and compared to the calculations in Exhibit F1b for consistency.

From the graph and comparison of the actual Red 7 true count frequency distribution with the normal approximation to that distribution, it can be seen that the normal distribution is not a good approximation for the Red 7 true count distribution. The normal approximation underestimates the Red 7 true count frequencies for Red 7 true counts less than -6 and greater than + 6 and also underestimates Red 7 true count frequencies for Red 7 true counts between -1 and +1. And for Red 7 true count

[20] Kurtosis = 3: mesokurtic, Kurtosis > 3: leptokurtic, Kurtosis < 3: platykurtic

between +1.5 and +5.5 and between -1.5 and -5.5, the normal approximation overestimates the Red 7 true count frequency (except for the spike at the Red 7 pivot point which is a Red 7 true count of +2).

So Red 7 true counts of +2 through +5 do not occur as often as they would if the Red 7 true count were normally distributed, but Red 7 true counts greater than +6 occur more frequently than they would if the Red 7 true count distribution were normally distributed.

Red 7 Hand Frequency
10,000 Six Decks, 4.5 Decks Dealt Simulation
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

Red 7 "tc"	Hand Freq	Hand %	Back count	Play	% Play at "tc"
-1	383,243	20.8%	20.8%	n/a	n/a
0	591,742	32.0%	32.0%	n/a	n/a
1	382,894	20.7%	20.7%	n/a	n/a
2	210,188	11.4%	n/a	11.4%	43.0%
3	121,507	6.6%	n/a	6.6%	24.9%
4	69,448	3.8%	n/a	3.8%	14.2%
5	39,230	2.1%	n/a	2.1%	8.0%
6	22,564	1.2%	n/a	1.2%	4.6%
7	12,902	0.7%	n/a	0.7%	2.6%
8	6,889	0.4%	n/a	0.4%	1.4%
9	3,949	0.2%	n/a	0.2%	0.8%
10	1,965	0.1%	n/a	0.1%	0.4%
Total	1,846,519	100.0%	73.5%	26.5%	100.0%

The above table shows Red 7 true counts >= -1 included in this Exhibit. Since table departure occurs at Red 7 true counts < -1, only Red 7 true counts >= -1 were considered in this chart. This shows that when actively back counting a table (true count does not drop to less than -1), then around 3/4th of the time the table would be back counted and around 1/4th of the time the table will be played.

Below is a graph of the Red 7 true count probability density function which is derived from the Red 7 true count frequency distribution. Here is can be seen that the Red 7 true count distribution is leptokurtic, i.e. the kurtosis is greater than the kurtosis of the normal distribution which is 3. The kurtosis of the Red 7 true count from this 10,000 shoe simulation was 5.39.

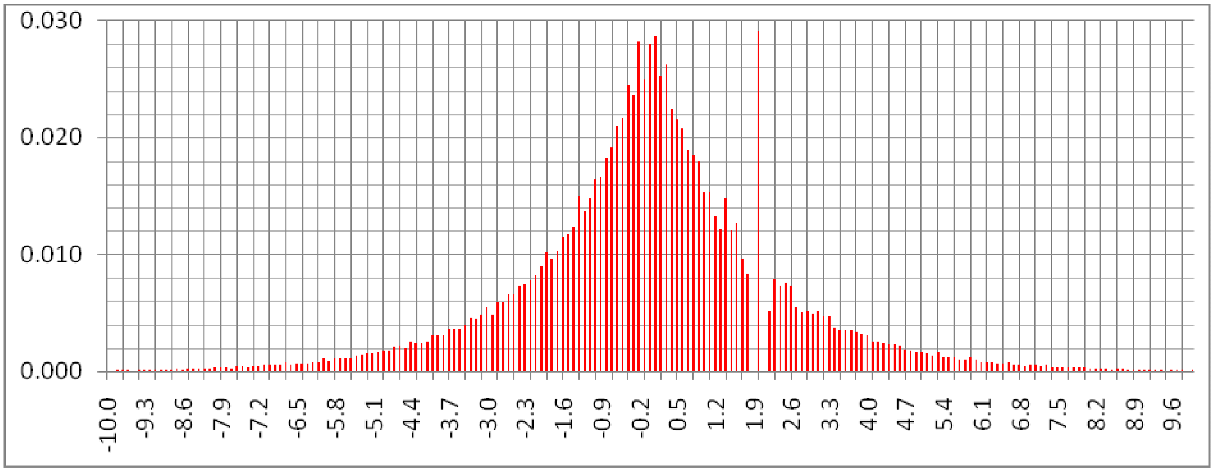
Red 7 True Count (PDF) Probability Density Function

10,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Truncated Distributed: -10 <= Red 7 True Count <= +10

Mean:	0.00	Skew:	0.01
Std Dev	2.44	Kurtosis:	5.39

f(x) = P(x - 0.05 < Red 7 True Count < x + 0.05) = P(x - 0.05 < X < x + 0.05), "x" in tenths



This graph clearly shows that the Red 7 true count distribution is not normally distributed. This distribution can be thought of as created from the corresponding normal distribution with mean zero and standard deviation 2.44 (which was the calculated mean and standard deviation from this simulation) by “squeezing” the normal distribution frequencies between +2 and +5 and -2 and -5 and then these displaced frequencies “popping up” at true count between -1 and +1 and “spread out” at true counts greater than or equal to +6 and less than or equal to -6.

This graph shows the Red 7 true count distribution truncated between -10 and +10. Since each of the 10,000 deck dealt consisted of dealing and recording 234 cards and true counts out of the 312 cards in six decks, then this would have resulted in recording 2,340,000 true counts if every true count was captures. Between -10 and +10, 2,335,135 true counts were captured. Thus the true count range between -10 and +10 gives (2,335,135/2,340,000) = 99.8% of the Red 7 True count distribution for four and a half out of six decks dealt. To give an idea of the extreme true counts that are possible because the Red 7 true count is leptokurtic, there were 12 true counts outside of the recorded true count range of -17.5 to +17.5. Even recording true counts between -17.5 and +17.5 did not capture every true count.

Exhibit F1e Red 7 and Hi-Low Running Count Distributions

The Red 7 running count distribution is included to give an idea of the ranges and frequencies of the various running counts in the six decks, four and half decks dealt game. The Red 7 running count simulation consisted of 15,000 six deck, four and half deck dealt shoes or 15,000 * 234 = 3,510,000 cards dealt and true counts recorded.

Every Red 7 running count was captured in this simulation. The Red 7 running counts ranged from -28 to +40. If the Red 7 running counts were restricted to be between -18 and +30 (the last values visible in the Red 7 running count graph below)[21] then all but 3,397 of the 3,510,000 Red 7 running counts were captured which means over 99.9% of the Red 7 running count distribution is accounted for with running counts between -18 and +30. But this last 0.1% of the running counts has some extreme values. To give an idea of the extreme Red 7 running counts possible, there were two occurrences of Red 7 running counts of +40 and four occurrences of Red 7 running counts of -28 in the 3,510,000 recorded running counts. If the Red 7 running count occurred at the cut card, i.e. decks played = 4.5, then using the formula tc = 2 + (rc – 2)/dr where rc = Red 7 running count and dr = decks remaining, the corresponding Red 7 true count would have been: 2 + (40 – 2) / (6.0 – 4.5) ≈ 21. This would give an upper value of the maximum Red 7 true count for the six deck, four and a half deck dealt game as +21.

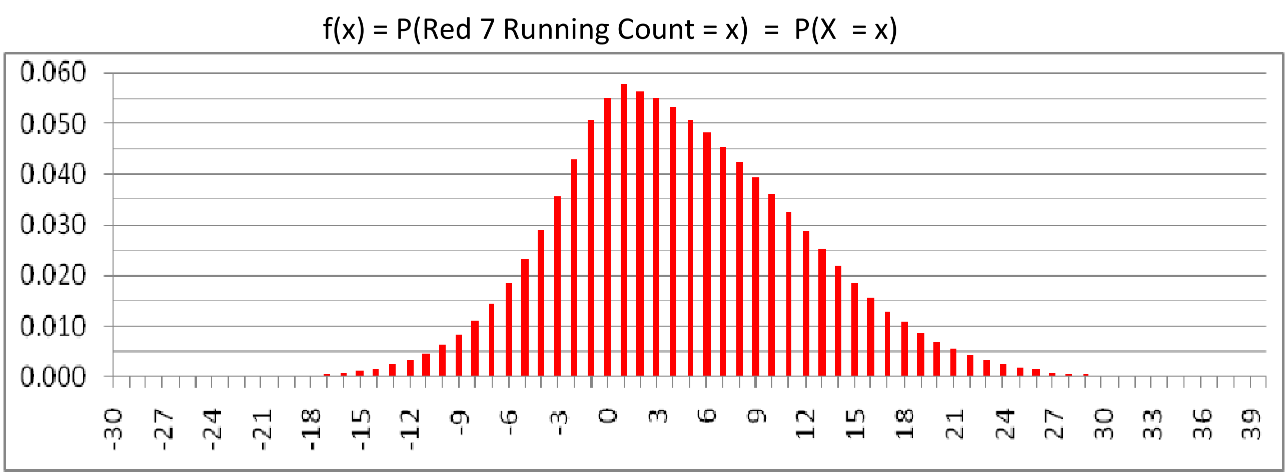
Red 7 Running Count (PDF) Probability Density Function

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Mean:	4.44 (i)	Skew:	0.28 (ii)
Standard Deviation:	7.38	Kurtosis:	3.13

(i) (Red 7 unbalance per deck) * (Average # decks played) = (2)*(4.5/2) = 4.5

(ii) Skew > 0: Distribution has longer right side tail relative to the mean.



[21] Notice that a Red 7 running count of 30 is 25.5 units to the right of the Red 7 mean of 4.5 and a Red 7 running count of -18 is 22.5 units to the left of the Red 7 mean of 4.5. This explain why the skew is positive since a positive skew means the distribution has a longer right side tail than a left side tail, relative to the mean. Skew is defined as E((X-μ)^3) / σ^3.

Exhibit F2: Accuracy of Red 7 True Count for Playing Strategy Variations

The purpose of this Exhibit is to demonstrate the importance of an accurate true count for playing strategy variations and how the Red 7 is not subject to the same inaccuracies as the Hi-Low true count calculations, which errors in the calculation of the true count can have disastrous consequences in decreasing the player's advantage if deviations from basic strategy occur before the index is reached. Hi-Low true count errors may arise from errors in estimating decks played, division errors, rounding errors or other errors, as outlined in the explanation of Exhibit E earlier. These errors in the calculation of true counts are minimized for the Red 7 count since the Red 7, for true counts of 2, 3, 4 and 5, is minimally affected by errors in estimating decks played. Also, since tables are used, there are no division errors. So the Red 7 count gives more accurate true counts than the Hi-Low which means the Red 7 gives more accurate playing strategy (and betting) variations than the Hi-Low. The devastating playing strategy error shown in this Exhibit from using the Hi-Low and similar playing strategy errors are virtually eliminated with the Red 7.

The example shown in this Exhibit is for insurance with the Hi-Low six deck index of 3.01.[22] The first situation shows the Hi-Low player miscalculating true count and insuring at a true count 2 instead of true count 3. The Hi-Low miscalculated true count can come from errors in estimating decks played, division errors, rounding errors, etc. As shown in Exhibit E, the Red 7 calculates true counts 2, 3, 4 and 5 more accurately than the Hi-Low and so is less subject, for true counts 2, 3, 4 and 5, to this type of error in deviating from basic strategy before the true count exceeds the critical index. The second situation is the Hi-Low player correctly insures at a true count of 3 and the third situation is the player waits to insure until he calculated a true count of 4. In the six deck game with 4.5 decks dealt, back counting and flat betting the average gain from insurance is 0.043% for the player who insures at true count of 2 and for the player who insures at a true count of 3 or 4, the average gain is around 0.122%. For the back counting player who spreads from 1 to 4 units, the average gain 0.188% for the player who insures at a Hi-Low true count of 2 and around 0.226% for the player who insures at a Hi-Low true count of 3 or 4.

So back counting, flat betting and insuring too early, at a true count of 2, the advantage gain from proper use of insurance is only (0.043 / 0.122) = 35% of the gain that can be obtained by waiting until the true count is 3 and for one to four betting the gain from insuring at a true count of 2 is (0.188 / 0.226) = 83% of the gain that could be obtained by waiting to insure until the true count 3.

Similar results in the decreases or elimination or reversal of the player's advantage occur for other strategic situations when basic strategy is changed too early due to improper calculation of the true count. Thus, the Red 7, which calculates true counts of 2, 3, 4 and 5 more accurately than the Hi-Low, will give a greater overall playing strategy gain from departing from basic strategy at the correctly calculated index.

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[22] Detailed calculations of insurance indices are shown In Exhibits J1 through J5.

Exhibit G1 – Red 7 Indices: S17 (Summary)

This Exhibit shows the Red 7 Indices for 1, 2, 6, 8 and infinite decks for Dealer Stands on soft 17 (S17). This is a summary of the detailed results for S17 shown in Exhibit H1.

Exhibit H1: Red 7 Indices: S17 (Detailed)

Exhibit H1 has the calculated indices for one, two, six, eight and infinite decks of the Red 7 for Dealer standing on soft 17 (S17). These calculations used the Effects of Removal from Blackjack Attack, 3rd edition, accurate to within 0.0001%. A least square line was fit between the tag values of each count and the Effects of Removal. See Exhibits I2, I3, J2 and J3 for sample calculations and explanations of how this is done. Proportional Deflection is an alternate method of calculating the true count indices. See Exhibits I4 and J4 for sample calculations and explanations of how proportional deflection is done. Both methods were used to calculate the true count indices and they yielded the same indices in all cases tested. The slope of the least square line is multiplied by (51/52) to give the Average Advantage Change per True Count Point (AACpTCp) for the given strategic situation. The reason for multiply the slope by (51/52) to get the AACpTCP can be seen by examining Exhibit K5, Effects of Removal Definition.

Exhibit G2 – Red 7 Indices: DAS (Summary)

This Exhibit shows the Red 7 Indices for 1, 2, 6, 8 and infinite decks for Double after Split (DAS). This is a summary of the detailed results for S17, DAS shown in Exhibit H2.

Exhibit H2: Red 7 Indices: S17 (Detailed)

Exhibit H1 has the calculated indices for one, two, six, eight and infinite decks of the Red 7 and Doubling after Split (DAS). These indices are calculated similar to Exhibit H1.

Exhibit G3 – Red 7 Indices: LS (Summary)

This Exhibit shows the Red 7 Indices for 1, 2, 6, 8 and infinite decks for Late Surrender (LS). This is a summary of the detailed results for LS shown in Exhibit H3.

Exhibit H3: Red 7 Indices: LS (Detailed)

Exhibit H3 has the calculated indices for one, two, six, eight and infinite decks of the Red 7 for Late Surrender (LS). These calculations in Exhibit H2 were done similar to Exhibit H1 calculations. Surrender reduces risk and also increases expectation when the proper indices are used.

Exhibit G4 – Red 7 Indices: H17 (Summary)

This Exhibit shows the Red 7 Indices for 1, 2, 6, 8 and infinite decks for Dealer Hits soft 17 (H17). This is a summary of the detailed results for H17 detailed results shown in Exhibit H4.

Exhibit H4: Indices: H17 (Detailed)

Exhibit H4 has the calculated indices for one, two, six, eight and infinite decks of the Red 7 for Dealer Hitting soft 17 (H17). These calculations in Exhibit H3 were done similar to Exhibit H1 calculations. Only selected situations were calculated where there was a difference in playing strategy between H17 and S17. The main differences with H17 can be seen in the chart on the last page of Exhibit A and a description of Exhibit A earlier in this paper.

Exhibit G5 – Red 7 Indices: NDAS (Summary)

This Exhibit shows the Red 7 Indices for 1, 2, 6, 8 and infinite decks No Double After Split (NDAS). This is a summary of the detailed results for NDAS shown in Exhibit H5.

Exhibit H5: Indices: NDAS (Detailed)

Exhibit H5 has the calculated indices for one, two, six, eight and infinite decks of the Red 7 for No Double after Split (NDAS). These calculations in Exhibit H4 were done similar to Exhibit H1 calculations. Only selected situations were calculated where there was a difference in playing strategy between DAS and NDAS. The main differences with NDAS can be seen in the chart on the last page of Exhibit A and a description of Exhibit A earlier in this paper.

Summary

The Red 7 has all of the desirable characteristics that a good count should have. It is (1) powerful, coming in slightly more powerful than the Hi-Low, (2) accurate, where the error in true count calculations for true counts 2, 3, 4 and 5 resulting from errors in estimating decks played is either eliminated or greatly reduced and is not subject to division or rounding errors either, (3) simple, in that in addition to being a level one count, no division is required, no interpolation and estimation to the nearest full deck is more than sufficient, and (4) speedy in that a quick and accurate decisions can be made by simply comparing the Red 7 count to the critical running count from the Red 7 table lookup corresponding to the true count index for the given playing strategy decision and the decks played.

Technical Section

This section may be skipped for the reader who is only interested in how to use this Truing the Red 7 method. This section is included for those who would like to see details of the calculations shown earlier in this paper.

Exhibit I1 – I5: Calculation of Index for NOT splitting 8,8 v T

This Exhibit details the calculations on when not to split 8,8 versus Ten for both No Double After Split (NDAS) and Double After Split (DAS). Blackjack Attack 3rd Edition (BJA3) Effects of Removal, EoR, were based on the difference of Splitting and Hitting decisions. But the decision if you are not going to split is to stand not hit, so the EoR of interest here is the difference splitting less standing. So this difference was estimated by using BJA3 EoR of hard 16 versus Ten which is the difference of standing and hitting decisions. So EoR, 8,8 v T, split less stand was calculated as BJA3 EoR 8,8 v T, split less hit minus BJA3 EoR hard 16 v Ten, stand less hit.

The LSL was then used with this resulting EoR and the Red 7 count to find the Red 7 indices for NOT splitting 8,8 versus Ten for both NDAS and DAS. It is to be noted that the Correlation Coefficient and the AACpTCp are both negative for 8,8 versus Ten which means that the player's advantage of splitting 8,8 versus Ten over standing decreases as the true count increases and at true counts greater than the index, the player advantage of splitting 8,8 versus Tens as opposed to standing is actually negative which means that the player is better off standing on 8,8 versus Ten over hitting when the true count is greater than or equal to the index.

Exhibit I1 shows the results for both NDAS and DAS for 1, 2, 6, 8 and infinite decks (and the results are also shown in Exhibit H1 for DAS and Exhibit H3 for NDAS). Below are shown the six deck results for NDAS and DAS from this Exhibit.

Negative Correlation Coefficient and AACpTCp		Count	**Red 7**
Stand if (tc) >= Index		Situation	***Split 8,8 v T, NDAS***

Count	Red 7
Situation	8,8 v T NDAS: split-std
k (# decks) =	6
Cor Coef	-51.42%
AACpTCp	-0.956%
FDHA,"k" dks	-4.961%
MDHA,"k" dks	-5.079%
MT, "k" dks	(0.168)
YI, "k" decks	(0.0194)
Prop Defl Idx	**5.12**

pa(t) = AACpTCp * (t - Idx)

k (# decks)	6
Red 7	8,8 v T NDAS: split-std
t	pa(t)
0	4.90%
1	3.94%
2	2.99%
3	2.03%
4	1.07%
5	0.12%
6	-0.84%

Negative Correlation Coefficient and AACpTCp		Count	**Red 7**
Stand if (tc) >= Index		Situation	***Split 8,8 v T, DAS***

Count	Red 7
Situation	8,8 v T DAS: split-std
k (# decks) =	6
Cor Coef	-47.78%
AACpTCp	-0.801%
FDHA,"k" dks	-6.068%
MDHA,"k" dks	-6.170%
MT, "k" dks	(0.168)
YI, "k" decks	(0.0194)
Prop Defl Idx	**7.51**

pa(t) = AACpTCp * (t - Idx)

k (# decks)	6
Red 7	8,8 v T DAS: split-std
t	pa(t)
0	6.02%
1	5.22%
2	4.42%
3	3.62%
4	2.81%
5	2.01%
6	1.21%
7	0.41%
8	-0.39%
9	-1.19%

So for the six deck game with NDAS, do NOT split (stand) on 8,8 versus Ten when the Red 7 true count is greater than 5.12 and for the six deck game with DAS, do NOT split (stand) on 8,8 versus Ten when the Red 7 true count is greater than 7.51. These have been judgmentally rounded down to 5 for the NDAS option and to 7 for the DAS option.

Details of these index calculations, for both the Least Squares Line (LSL) method and Proportional Deflection (PD) method are shown in Exhibits I2, 13 and I4 and Exhibit I5 shows the calculation of the Full Deck House Advantage (FDHA) by number of decks. FDHA and player's advantage (pa) are both defined in Exhibit K6.

Exhibit J1 – J5: Calculation of Insurance Index

Exhibit J1 shows the calculated insurance indices and correlation coefficients for the Hi-Low and Red 7 for one, two, six, eight and infinite decks. The results are shown below.

Hi-Low

k, # decks	1	2	6	8	Infinite
Corr Coef	78.85%	77.41%	76.47%	76.36%	76.01%
Index	1.42	2.38	3.01	3.09	3.33

Red 7

k, # decks	1	2	6	8	Infinite
Corr Coef	80.02%	78.53%	77.57%	77.46%	77.10%
Index	1.40	2.38	3.04	3.12	3.36

The details of these calculations are somewhat technical and are set forth in Exhibits J2, J3, J4 and J5.

Exhibit K1 – K8:

Exhibit K1 **Correlation Coefficient and Average Advantage Change per True Count point**
Exhibit K2 **Least Squares Line**
Exhibit K3 **Relationships between AACpTCp, Indices, Corr. Coef, and Std Dev.**
Exhibit K4 **Infinite Deck Index under a Linear Transformation**
Exhibit K5 **Effect of Removal Definition**
Exhibit K6 **Full Deck House Advantage and Player's Advantage Definition**
Exhibit K7a **LSL Fit between Red 7 & Hi-Low and Red 7 & KO**
Exhibit K7b **LSL Test between Red 7 & Hi-Low and Red 7 & KO**
Exhibit K7c **Count Table**
Exhibit K7d **Half Deck Shuffling**
Exhibit K8 **Generalized True Count**

Exhibit K1 summarizes the Least Squares Line (LSL) approach to the calculation of Indices and shows some formulas and relationships of the Correlation Coefficient under a linear transformation.

Some sample calculations of the LSL have been shown previously in Exhibits I2, I3 for not splitting 8,8 v T, NDA and DAS and J2 and J3 for insurance.

Exhibit K2 shows a few more Index calculations for various counts under the infinite deck assumption.

Exhibit K3 shows the relationships between AACpTCp and Indices with CC and SD.

Exhibit K4 shows the relationship with Infinite Deck Index values under a linear transformation.

Exhibit K5 is the Effects of Removal Definition with some sample calculations of EoR.

Exhibit K6 is the definitions of ”FDHA” and “pa” with some sample calculations.

Exhibit K7a fits a least squares line to Red 7 & Hi-Low and Red 7 & KO. This Exhibit then shows how to take into account the unbalances in these counts in deriving an equation for these relationships. In Exhibit 7b the equations are tested by using the 26 cards Red 2 though Black Ace and the estimates are calculated as each card is played. The average absolute value of the error is calculated for each estimate and an average of ten trial shuffles is taken. All three estimates have small errors and estimate Red 7 fairly well with large correlation coefficients that are essentially equal. Exhibit 7c is a count decoding table and Exhibit 7d is a half deck shuffling procedure. Exhibits 7c and 7d were used in the simulation of the ten trials of half deck shuffling in Exhibit 7b.

Exhibit K8 shows the generalized true count formulas for balanced or unbalanced counts along with a summary formula for the calculations of Indices using the Least Squares Line method. Also shown are several different versions of the generalized running count formula, including the shifted running count, where for the Red 7, the count starts at the beginning of the shoe (or converted to this count later in show once the running count exceeds the pivot) at -2*(number of decks) instead of starting at zero.

Exhibits L1 – L4:
Estimation of FDHA for “k” decks by Method of Interpolation of Reciprocals

The Full Deck House advantage for a given situation varies by the number or decks. The FDHA for a given number or decks can be estimated by a linear interpolation of the reciprocal of the number of decks and the FDHA as explained in the Theory of Blackjack. For linear interpolation of reciprocals, tThe FDHA for one deck and eight decks were used to calculate a linear interpolation formula for the FDHA for any number or decks for a given strategic situation. The formula derived for FDHA(k) = Full Deck House advantage for “k” decks as shown in Exhibit L1 is:

$$FDHA(k) = FDHA(1) * \{ (1/7) * (8/k - 1) \} + FDHA(8) * \{ (8/7) * (1 - (1/k)) \}$$

Exhibit L2 shows Cramer’s Rule which was used to calculate the quadratic (Exhibit L3) and cubic (Exhibit L4) equations for the FDHA by deck by fitting three FDHA by decks and four FDHA points by decks for the quadratic and cubic equations, respectively.

Truing the Red 7 Count
by Conrad Membrino
January 2010

RED 7 Count
Six Decks with at least Four and a Half Decks Dealt

Red 7 (R7) count values

Card	R7 value	Card	R7 value
2	1	8	0
3	1	9	0
4	1	10	-1
5	1	J	-1
6	1	Q	-1
Red 7	1	K	-1
Black 7	0	A	-1

Optimal Departure Point (ODP)

ODP = when to stop back counting table and move onto another table *

*ODP: tc = 2 + (rc - 2*n) / dr < -1.0 ==> rc < (12 - 3*dr), n = 6 ***

Number of Decks (n) = **6**

	Decks Played	Decks Rem.	Depart if Red 7 < (12 - 3*dr)		
	1.0	5.0	-3.0	-3	
	2.0	4.0	0.0	0	
half dealt	3.0	3.0	3.0	3	*half dealt*
	4.0	2.0	6.0	6	

** ODP from Blackjack Attack, 3rd edition, by Don Schlesinger*

Note: True count of -1 is close to the average ODP recommended for several different penetrations and conditions studied in Blackjack Attack, 3rd edition.

Six Decks

*rc = 12 + (tc - 2) * dr*

true count	*decks played* 2	3	4	Suggested Units Bet
2	12	***12***	12	1
3	16	***15***	14	2
4	20	***18***	16	3
5	24	***21***	18	4 (max)

Read down Decks Played Column for betting

Six Decks

*rc = 12 + (tc - 2) * dr*

true count	*decks played* 2	3	4
2	12	***12***	12
3	16	***15***	14
4	20	***18***	16
5	24	***21***	18

Read across True Count Row for playing strategy variations

*** Reference:*

http://www.blackjackforumonline.com/content/membr1.htm

*tc = 2.0 + (rc - 2*n) / dr where tc = true count, rc = Red 7 running count, n = number of decks, dr = decks remaining, dp = decks played*

SIX DECK UNBALANCED RED-7 RUNNING COUNT CONVERSION TO EQUIVALENT HI-LO BALANCED TRUE COUNT AND SENSITIVITY OF TRUE COUNT TO ERRORS IN ESTIMATING DECKS REMAINING

By Conrad Membrino

(From *Blackjack Forum* Vol. XVII #4, Winter 1997)

Red 7 True Count Indices

Situations in Red: Indices greater than 2.0

Situations in Pink: Red 7 Index at pivot point true count of 2.0

Situations in Blue: Indices between -2 and 0 (in case back counting not possible)

Player's Hand	Dealer's Up Card										
	S17										**H17**
	2	3	4	5	6	7	8	9	T	A	A
8				4	2						
9	2	d	d	d	d	4					
10	d	d	d	d	d	d	d	d	4	4	3
11	d	d	d	d	d	d	d	d	d	2	double
12	3+	2	0	-2	-1						
13	-1	-2	s	s	s						
15						h	h	h	4	h	6
16						h	h	5	0	h	4
A2			4	d	d						
A3			3	d	d						
A4			d	d	d						
A5		5	d	d	d						
A6	2	d	d	d	d	h	h	h	h	h	"
A7	2	d	d	d	d	s	s	h	h	2	hit
A8		5	4	2	2						
A9				5	5						
	DAS (Double After Split)										
2,2	sp	sp	sp	sp	sp	sp	5				
3,3	sp	sp	sp	sp	sp	sp					
4,4			3	sp	sp						
6,6	sp	sp	sp	sp	sp						
7,7	sp	sp	sp	sp	sp	sp	3				
8,8	sp	sp	sp	sp	sp	sp	sp	sp	7 *	sp	"
9,9	sp	sp	sp	sp	sp	4	sp	sp	std	3	2
T,T				5+	5						
A,A	sp	sp	sp	sp	sp	sp	sp	sp	sp	sp	"

h9 v 2 double, h11 v A S17 double, A7 v 2 double, soft 18 v A S17 stand, and A8 v 6 S17 double have indices of +1 but are rounded up to +2 in chart above.

This Table of True Count Indices is for six and eight deck games. d = double s = stand h = hit sp = split

s, d, or sp if true count greater than index in chart above. * 8,8 v T DAS: split if Red 7 true count below index, i.e. split if tc <= 7, otherwise stand.

Doubling h10 v T: six deck AACpTCp = 0.97% (compared to 2.63% for h10 v A). Risk adjusted doubling index is 5 or 6. (See Exhibit H1)

Red 7 True Count Indices

Player's Hand	Dealer's Up Card										
	S17										**H17**
	2	3	4	5	6	7	8	9	T	A	A
	NDAS (No Double After Split)										
2,2	hit	hit	sp	sp	sp	sp					
3,3	hit	5	sp	sp	sp	sp					
6,6	2	sp	sp	sp	sp						
7,7	sp	sp	sp	sp	sp	sp					
8,8	sp	sp	sp	sp	sp	sp	sp	sp	5 *	sp	
9,9	sp	sp	sp	sp	sp	std	sp	sp	std	4	3
T,T				5+	5						
A,A	sp	sp	sp	sp	sp	sp	sp	sp	sp	sp	"

This Table of True Count Indices is for six and eight deck games.

* 8,8 v T NDAS: split if Red 7 true count below index, i.e. split if tc <= 5, otherwise stand.

Notes:

(1) See Exhibits G1 to G4 and H1 to H4 for details on Indices for each of these playing strategy variations.

(2) Exhibits G2, H2 and I1: do NOT split, i.e. stand, on 8,8 v T DAS if six deck Red 7 true count >= 7.51.

(3) Exhibits G4, H4 and I1: do NOT split, i.e. stand, on 8,8 v T NDAS if Six Deck Red 7 true count >= 5.12.

(4) This Table of True Count Indices is for six and eight deck games.

d = double   s = stand   h = hit   sp = split

The main differences with H17 are (Exhibit G3):

(1) Double 10 v A DAS if Red 7 true count >= 3.
(2) Double 11 v A and A8 v 6 (basic strategy).
(3) Stand on hard 12 versus 6 if the Red 7 true count >= -3.
(4) Stand on hard 15 versus Ace if the Red 7 true count >= 6.
(5) Stand on hard 16 versus Ace if the Red 7 true count >= 4.
(6) Hit soft 18 versus Ace.
(7) Double A9 v 6 if Red 7 true count >= 4.
(8) Split 9,9 v A DAS if Red 7 true count >= 2.
(9) Late Surrender h15 v A (basic strategy).
(10) Late Surrender h14 v A if Red 7 true count >= 4.

The main differences with NDAS are:

(1) Split 2,2 vs. 4, 5, 6 and 7 only.
(2) Split 3,3 vs. 4, 5, 6, 7 & vs. a 3 if Red 7 tc >= 5.
(3) Split 6,6 vs. 3, 4, 5, 6 & vs. a 2 if Red 7 tc >= 2.
(4) Do NOT split Eights (stand on the hard 16) vs. a Ten if Red 7 tc >= 5.
(5) Stand on Nines vs. a Seven.
(6) Split Nines vs. Ace, S17 at Red 7 true count >= 4.
(7) Split Nines vs. Ace, H17 at Red 7 true count >= 3.

Red 7 Count

	Late Surrender Indices Dealer's Up Card				
Player's	S17				H17
Hand	8	9	T	A	A
h17					2 *
h16	5	sur	sur	sur	sur
h15		3	sur	2	sur
h14			3		4
8,8			2		2 *
7,7			2		3

(See Exhibits G5 and H5) Table above for six and eight deck games.

surrender if true count >= index. * If H17, then surrender h17 v A and 8,8 v A if true count <= index.

Under H17, h15 v A surrender become a basic strategy play.

Under H17, h17 v A surrender become a basic strategy play but has a negative CC and AACpTCp and so if true count >= Idx, then stand.

Under H17, 8,8 v A surrender become a basic strategy play but has a negative CC and AACpTCp and so if true count >= Idx, then split.

Six Deck Insurance

		Decks Played				
Count	True Count **	1	2	3	4	5
Red 7	3.0	17	16	15	14	13

Insure if Red 7 >= 12 + dr: 17, 16, 15, 14, 13 corresponding to dp = 1, 2, 3, 4 and 5 respectively.

Red 7 Insurance Index: 6 deck is 3.04 and 8 deck is 3.12. (See Exhibit J1)

Table of Six Deck Running Counts

rc = 12 + (tc - 2) * dr

Six deck running count	*true count*	*decks played (dp)* 1	2	*3*	4	5	Units Bet
12 - 3*dr	*-1*	-3	0	3	6	9	0
12 - 2*dr	*0*	2	4	6	8	10	0
12 - dr	*1*	7	8	9	10	11	0 or 1
12	*2*	12	12	***12***	12	12	1
12 + dr	*3*	17	16	***15***	14	13	2
12 + 2*dr	*4*	22	20	***18***	16	14	3
12 + 3*dr	*5*	27	24	***21***	18	15	4 (max)
12 + 4*dr	*6*	32	28	24	20	16	4 (max)

Read down Decks Played Column for betting

Read across True Count Row for playing strategy variations

RED 7 Count
How to use Table of Running Counts for Betting

Six Deck

*rc = 12 + (tc - 2) * dr*

Six deck running count	*true count*	*decks played* 2	3	4	Suggested Units Bet
12	*2*	12	***12***	12	1
12 + dr	*3*	16	***15***	14	2
12 + 2*dr	*4*	20	***18***	16	3
12 + 3*dr	*5*	24	***21***	18	4 (max)
	decks played	*1.5 to 2.5*	*2.5 to 3.5*	*3.5 to 4.5*	

Read down Decks Played Column for betting

Precise way to bet

(1) If decks played is 2 (between 1.5 and 2.5) then bet 1, 2, 3 and 4 units at Red 7 counts of 12, 16, 20 and 24 respectively.
(2) If decks played is 3 (between 2.5 and 3.5) then bet 1, 2, 3 and 4 units at Red 7 counts of 12, 15, 18 and 21 respectively.
(3) If decks played is 4 (between 3.5 and 4.5) then bet 1, 2, 3 and 4 units at Red 7 counts of 12, 14, 16 and 18 respectively.

Building Table, Pattern # 1, Six Decks

Build Table

true count	*decks played* add	*base*	add
2	0	***12***	0
3	1	***15***	-1
4	2	***18***	-2
5	3	***21***	-3

*rc = 12 + (tc - 2) * dr*

true count	*decks played* 2	*3*	4
2	12	***12***	12
3	16	***15***	14
4	20	***18***	16
5	24	***21***	18

Building Table, Pattern # 2, Six Decks

Build Table

true count	*decks played* *2*	3	4
base	***12***	***12***	***12***
add	4	3	2
add	4	3	2
add	4	3	2

*rc = 12 + (tc - 2) * dr*

true count	*decks played* *2*	3	4
2	***12***	***12***	***12***
3	16	15	14
4	20	18	16
5	24	21	18

RED 7 Count
How to use Table of Running Counts for Playing Strategy Variations

Six Decks
*rc = 12 + (tc - 2) * dr*

Six deck running count	*true count*	*decks played* 2	3	4
12	*2*	12	***12***	12
12 + dr	*3*	16	***15***	14
12 + 2*dr	*4*	20	***18***	16
12 + 3*dr	*5*	24	***21***	18

Read across True Count Row for playing strategy variations

Precise way to determine playing strategy variations

(1) Look up index for the given situation *Table of True Count Indices*
(2) Look up the running count in *Table of Running Counts* corresponding to the true count from (1) and decks played.
(3) If Red 7 running count >= running count (2), then make the playing strategy change.

Examples:

(1) T,T v 6 Split
Index is 5. True count row 5 is: 24, 21, 18 corresponding to decks played 2, 3 and 4 respectively.
If decks played = 2, Split T,T v 6 if Red 7 >= 24
If decks played = 3, Split T,T v 6 if Red 7 >= 21
If decks played = 4, Split T,T v 6 if Red 7 >= 18

(2) Insurance
Index is 3. True Count row 3 is: 16, 15, 14 corresponding to dp = 2, 3 and 4 respectively.
If decks played = 2, Insure if Red 7 >= 16
If decks played = 3, Insure if Red 7 >= 15
If decks played = 4, Insure if Red 7 >= 14

(3) h 9 v 7
Index is 4. True count row 4 is: 20, 18, 16 corresponding to dp = 2, 3 and 4 respectively.
If decks played = 2, Double h 9 v 7 if Red 7 >= 20
If decks played = 3, Double h 9 v 7 if Red 7 >= 18
If decks played = 4, Double h 9 v 7 if Red 7 >= 16

Red 7 running count for 6 deck game

Interpolating between True Count Rows or Decks Played Columns

Extrapolating beyond given True Count Rows or Decks Played Columns

Six Decks

rc = 12 + (tc - 2) * dr

Six deck running count	*true count*	*decks played (dp)* 1	2	3	4	5	Units Bet
12 - 3*dr	*-1*	-3	0	3	6	9	0
12 - 2*dr	*0*	2	4	6	8	10	0
12 - dr	*1*	7	8	9	10	11	0 or 1
12	*2*	12	12	***12***	12	12	1
12 + dr	*3*	17	16	***15***	14	13	2
12 + 2*dr	*4*	22	20	***18***	16	14	3
12 + 3*dr	*5*	27	24	***21***	18	15	4 (max)
12 + 4*dr	*6*	32	28	24	20	16	4 (max)

Read down Decks Played Column for betting

Read across True Count Row for playing strategy variations

The given critical running count table for Red 7 true counts of 2, 3, 4 and 5 and decks played 2, 3, and 4 should be sufficient for most situations. If additional accuracy is desired the critical running count table can be interpolated between true count rows or decks played columns or extrapolated beyond given true count rows or decks played columns by using either of both Table Building Patterns shown earlier.

Example 1: Interpolation between true count rows.

Situation: dp = 2.0, Red 7 = 18, betting. Column dp = 2 is Red 7 counts 12, 16, 20 and 24 corresponding to true counts 2, 3, 4 and 5 respectively and suggested bets of 1, 2, 3 and 4 units respectively. So a Red 7 count of 18 would correspond to a true count of 3.5 and a suggested bet of 2.5 units.

Example 2: Interpolation between decks played columns

Situation: dp = 2.5, A8 v 3. The Index for A8 v 3 is a true count of 5 and true count row 5 is 24, 21, 18 corresponding to dp = 2, 3, and 4 respectively. So true count row 5 at dp = 2.5 would be a Red 7 count of 22.5 which must be rounded to 23. So in this case, double A8 v 3 if Red 7 >= 23, otherwise stand.

Example 3: Extrapolation beyond given decks played columns

Situation: dp = 5 column is desired. dp = 4 column has Red 7 counts 12, 14, 16, 18 corresponding to true counts 2, 3, 4 and 5 and suggested bets of 1, 2, 3 and 4 units. Using either Table Building Pattern 1 or 2, dp = 5 column is calculated as Red 7 counts of 12, 13, 14 and 15 corresponding to true counts 2, 3, 4 and 5 and suggested bets of 1, 2, 3, and 4 units

Example 4: Extrapolation beyond given true count rows.

Situation: tc = 1 row is desired. Using tc = 2 row and Table Building Pattern 2, tc = 1 row is calculated as Red 7 counts of 8, 9 and 10 corresponding to dp = 2, 3 and 4 respectively.

Red 7 Strategy Changes

Six decks

rc = 12 + (tc - 2)*dr = (2 - tc)*dp + 6*tc

dr = decks remaining, dp = decks played, n = number of decks = (dp + dr) = 6

(Exhibit K8)

rc = u*n + (tc - u)*dr
rc = u*dp + tc*dr
rc = (u - tc)*dp + n*tc
src = shifted running count = (rc - u*n) so src = (tc - u)*dr

Red 7, Six decks

<u>Red 7, Six decks</u>

u = 2, n = 6:
rc = (2 - tc)*dp + 6*tc
rc = 2*dp + tc*dr
rc = 12 + (tc - 2)*dr
src = rc - 12
src = (tc - 2)*dr

tc	rc	rc	rc	src
5	-	-	12 + 3*dr	3*dr
4	-	-	12 + 2*dr	2*dr
3	-	-	12 + dr	dr
2	12	12	12	0
1	dp + 6	2*dp + dr	12 - dr	(-1)*dr
0	2*dp	2*dp	12 - 2*dr	(-2)*dr
-1	3*dp - 6	2*dp - dr	12 - 3*dr	(-3)*dr
-2	4*dp - 12	2*dp - 2*dr	12 - 4*dr	(-4)*dr

Red 7 Strategy Changes
Six decks

If rc >= 12 + (Idx - 2)*dr then strategy change

dr = decks remaining, dp = decks played, n = number of decks = (dp + dr) = 6

Red 7 True Count Index	
3	Insure if Red 7 >= 12 + dr
2	Double h8 v 6 if Red 7 >= 12
4	Double h8 v 5 if Red 7 >= 12 + 2*dr
2*	Double h9 v 2 if Red 7 >= 12
4	Double h9 v 7 if Red 7 >= 12 + 2*dr
4	Double h10 v T if Red 7 >= 12 + 2*dr
4	Double h10 v A, S17 if Red 7 >= 12 + 2*dr
3	Double h10 v A, H17 if Red 7 >= 12 + dr
2*	Double h11 v A, S17 if Red 7 >= 12
3.3	Stand h12 v 2 if Red 7 >= 12 + 1.3*dr
2	Stand h12 v 3 if Red 7 >= 12
0	Stand h12 v 4 if Red 7 >= 12 - 2*dr = 2*dp
-2	Stand h12 v 5 if Red 7 >= 12 - 4*dr
-1	Stand h12 v 6 if Red 7 >= 12 - 3*dr
-1	Stand h13 v 2 if Red 7 >= 12 - 3*dr
-2	Stand h13 v 3 if Red 7 >= 12 - 4*dr
4	Stand h15 v T if Red 7 >= 12 + 2*dr
0	Stand h16 v T if Red 7 >= 12 - 2*dr = 2*dp
5	Stand h16 v 9 if Red 7 >= 12 + 3*dr
4	Stand h16 v A, H17 if Red 7 >= 12 + 2*dr
4	Double A2 v 4 if Red 7 >= 12 + 2*dr
3	Double A2 v 3 if Red 7 >= 12 + dr
5	Double A5 v 3 if Red 7 >= 12 + 3*dr
2	Double A6 v 2 if Red 7 >= 12
2*	Double A7 v 2 if Red 7 >= 12
2*	Stand Soft 18 v A if Red 7 >= 12
2*	Double A8 v 6 if Red 7 >= 12
2	Double A8 v 5 if Red 7 >= 12

Red 7 True Count Index	
4	Double A8 v 4 if Red 7 >= 12 + 2*dr
5	Double A8 v 3 if Red 7 >= 12 + 3*dr
5	Double A9 v 6 if Red 7 >= 12 + 3*dr
5	Double A9 v 5 if Red 7 >= 12 + 3*dr
5	Split 2,2 v 8 DAS if Red 7 >= 12 + 3*dr
3	Split 4,4 v 4 DAS if Red 7 >= 12 + dr
3	Split 7,7 v 8 DAS if Red 7 >= 12 + dr
7	*Do NOT split 8,8 v T, DAS if Red 7 >= 12 + 5*dr*
4	Split 9,9 v 7 DAS if Red 7 >= 12 + 2*dr
3	Split 9,9 v A DAS, S17 if Red 7 >= 12 + dr
2	Split 9,9 v A DAS, H17 if Red 7 >= 12
5	Split T,T v 6 if Red 7 >= 12 + 3*dr
5.3	Split T,T v 5 if Red 7 >= 12 + 3.3*dr
5	Split 3,3 v 3 NDAS if Red 7 >= 12 + 3*dr
2	Split 6,6 v 2 NDAS if Red 7 >= 12
5	*Do NOT split 8,8 v T, NDAS if Red 7 >= 12 + 3*dr*
4	Split 9,9 v A NDAS, S17 if Red 7 >= 12 + 2*dr
3	Split 9,9 v A NDAS, H17 if Red 7 >= 12 + dr
2	Late Surrender h15 v A, S17 if Red 7 >= 12
3	Late Surrender h14 v T if Red 7 >= 12 + dr
3	Late Surrender h15 v 9 if Red 7 >= 12 + dr
5	Late Surrender h16 v 8 if Red 7 >= 12 + 3*dr
2	Late Surrender 8,8 v T if Red 7 >= 12
2	Late Surrender 7,7 v T if Red 7 >= 12
2	*Late Surrender h17 v A, H17 if Red 7 <= 12*
4	Late Surrender h14 v A, H17 if Red 7 >= 12 + 2*dr
2	*Late Surrender 8,8 v A, H17 if Red 7 <= 12*
3	Late Surrender 7,7 v A, H17 if Red 7 >= 12 + dr

* h9 v 2 double, h11 v A S17 double, A7 v 2 double, soft 18 v A S17 stand, and A8 v 6 S17 double have indices of +1 but are rounded up to +2 in table above.

RED 7 Count
Eight Decks with at least Six and a Half Decks Dealt

Red 7 (R7) count values

Card	R7 value	Card	R7 value
2	1	8	0
3	1	9	0
4	1	10	-1
5	1	J	-1
6	1	Q	-1
Red 7	1	K	-1
Black 7	0	A	-1

Optimal Departure Point (ODP)

ODP = when to stop back counting table and move onto another table *

*ODP: tc = 2 + (rc - 2*n) / dr < -1.0 ==> rc < (16 - 3*dr), n = 8 ***

Number of Decks (n) = **8**

	Decks Played	Decks Rem.	Depart if Red 7 < (16 - 3*dr)	
	1.0	7.0	-5.0	-6
	2.0	6.0	-2.0	-3
	3.0	5.0	1.0	0
half dealt	4.0	4.0	4.0	3
	5.0	3.0	7.0	6
	6.0	2.0	10.0	9

** ODP from Blackjack Attack, 3rd edition, by Don Schlesinger*

Note: True count of -1 is close to the average ODP recommended for several different penetrations and conditions studied in Blackjack Attack, 3rd edition.

Eight Decks

*rc = 16 + (tc - 2) * dr*

	decks played			Suggested
true count	2	*4*	6	Units Bet
2	16	***16***	16	1
3	22	***20***	18	2
4	n/a	***24***	20	3
5	n/a	***28***	22	4 (max)

Read down Decks Played Column for betting

dp < 3: max bet = 2 units

Eight Decks

*rc = 16 + (tc - 2) * dr*

	decks played		
true count	2	*4*	6
2	16	***16***	16
3	22	***20***	18
4	n/a	***24***	20
5	n/a	***28***	22

Read across True Count Row for playing strategy variations

dp < 3: no playing strategy variations for tc > 3.

*** Reference:*

http://www.blackjackforumonline.com/content/membr1.htm

*tc = 2.0 + (rc - 2*n) / dr where tc = true count, rc = Red 7 running count, n = number of decks, dr = decks remaining, dp = decks played*

SIX DECK UNBALANCED RED-7 RUNNING COUNT CONVERSION TO EQUIVALENT HI-LO BALANCED TRUE COUNT AND SENSITIVITY OF TRUE COUNT TO ERRORS IN ESTIMATING DECKS REMAINING

By Conrad Membrino

(From *Blackjack Forum* Vol. XVII #4, Winter 1997)

RED 7 Count
How to use Table of Running Counts for Betting

Eight Decks
rc = 16 + (tc - 2) * dr
decks played (dp)

Eight deck running count	*true count*	2	*4*	6	Units Bet
16	*2*	16	***16***	16	1
16 + dr	*3*	22	***20***	18	2
16 + 2*dr	*4*	n/a	***24***	20	3
16 + 3*dr	*5*	n/a	***28***	22	4 (max)
	decks played	*<= 3*	*3 to 5*	*5 to 7-*	

Read down Decks Played Column for betting

dp < 3: max bet = 2 units

Precise way to bet

(1) If decks played is 1, 2 or 3 then bet 1, 2 units at Red 7 counts of 16, 22 respectively. Maximum bet is 2 units
(2) If decks played is 3, 4 or 5 then bet 1, 2, 3 and 4 units at Red 7 counts of 16, 20, 24 and 28 respectively.
(3) If decks played is 5, 6 or 7 then bet 1, 2, 3 and 4 units at Red 7 counts of 16, 18, 20 and 22 respectively.
(4) If decks played is 7 then bet 1, 2, 3 and 4 units at Red 7 counts of 16, 17, 18 and 19 respectively.

Table of Running Counts

Red 7 running count for 8 deck game
rc = 16 + (tc - 2) * dr
decks played (dp)

Eight deck running count	*true count*	1	2	3	*4*	5	6	7	Units Bet
16 - 3*dr	*-1*	-5	-2	1	4	7	10	13	0
16 - 2*dr	*0*	2	4	6	8	10	12	14	0
16 - dr	*1*	9	10	11	12	13	14	15	0 or 1
16	*2*	16	16	16	***16***	16	16	16	1
16 + dr	*3*	23	22	21	***20***	19	18	17	2
16 + 2*dr	*4*	30	28	26	***24***	22	20	18	3
16 + 3*dr	*5*	37	34	31	***28***	25	22	19	4 (max)
16 + 4*dr	*6*	44	40	36	32	28	24	20	4 (max)

Read down Decks Played Column for betting
Read across True Count Row for playing strategy variations

RED 7 Count
How to use Table of Running Counts for Playing Strategy Variations

Eight Decks
rc = 16 + (tc - 2) * dr

Eight deck running count		decks played (dp)		
	true count	2	*4*	6
16	*2*	16	***16***	16
16 + dr	*3*	22	***20***	18
16 + 2*dr	*4*	n/a	***24***	20
16 + 3*dr	*5*	n/a	***28***	22

Read across True Count Row for playing strategy variations

dp < 3: no playing strategy variations for tc > 3.

Precise way to determine playing strategy variations

(1) Look up index for the given situation *Table of True Count Indices*
(2) Look up the running count in *Table of Running Counts* corresponding to the true count from (1) and decks played.
(3) If Red 7 running count >= running count (2), then make the playing strategy change.

<u>*Examples:*</u>

(1) T,T v 6 Split
Index is 5. True Count row 5 is: 28, 22 corresponding to decks played 4 and 6 respectively.
If decks played = 2, Stand T,T v 6. (No strategy changes for true counts > 3 if deck played < 3.)
If decks played = 4, Split T,T v 6 if Red 7 >= 28
If decks played = 6, Split T,T v 6 if Red 7 >= 22

(2) Insurance
Index is 3. True Count row 3 is: 22, 20, 18 corresponding to dp = 2, 4 and 6 respectively.
If decks played = 2, Insure if Red 7 >= 22
If decks played = 4, Insure if Red 7 >= 20
If decks played = 6, Insure if Red 7 >= 18

(3) h 9 v 7
Index is 4. True Count row 4 is: 24, 20 corresponding to decks played 4 and 6 respectively.
If decks played = 2, Hit h 9 v 7. (No strategy changes for true counts > 3 if deck played < 3.)
If decks played = 4, Double h 9 v 7 if Red 7 >= 24
If decks played = 6, Double h 9 v 7 if Red 7 >= 20

Red 7 Strategy Changes
Eight decks

rc = 16 + (tc - 2)*dr = (2 - tc)*dp + 8*tc

dr = decks remaining, dp = decks played, n = number of decks = (dp + dr) = 8

(Exhibit K8)

rc = u*n + (tc - u)*dr
rc = u*dp + tc*dr
rc = (u - tc)*dp + n*tc
src = shifted running count = (rc - u*n) so src = (tc - u)*dr

Red 7, Eight decks

Red 7, Eight decks

u = 2, n = 8:

rc = (2 - tc)*dp + 8*tc

rc = 2*dp + tc*dr

rc = 16 + (tc - 2)*dr

src = rc - 16

src = (tc - 2)*dr

tc	rc	rc	rc	src
5	-	-	16 + 3*dr	3*dr
4	-	-	16 + 2*dr	2*dr
3	-	-	16 + dr	dr
2	16	16	16	0
1	dp + 8	2*dp + dr	16 - dr	(-1)*dr
0	2*dp	2*dp	16 - 2*dr	(-2)*dr
-1	3*dp - 8	2*dp - dr	16 - 3*dr	(-3)*dr
-2	4*dp - 16	2*dp - 2*dr	16 - 4*dr	(-4)*dr

Red 7 Strategy Changes
Eight decks

If rc >= 16 + (Idx - 2)*dr then strategy change

dr = decks remaining, dp = decks played, n = number of decks = (dp + dr) = 8

Red 7 True Count Index	
3	Insure if Red 7 >= 16 + dr
2	Double h8 v 6 if Red 7 >= 16
4	Double h8 v 5 if Red 7 >= 16 + 2*dr
2*	Double h9 v 2 if Red 7 >= 16
4	Double h9 v 7 if Red 7 >= 16 + 2*dr
4	Double h10 v T if Red 7 >= 16 + 2*dr
4	Double h10 v A, S17 if Red 7 >= 16 + 2*dr
3	Double h10 v A, H17 if Red 7 >= 16 + dr
2*	Double h11 v A, S17 if Red 7 >= 16
3.3	Stand h12 v 2 if Red 7 >= 16 + 1.3*dr
2	Stand h12 v 3 if Red 7 >= 16
0	Stand h12 v 4 if Red 7 >= 16 - 2*dr = 2*dp
-2	Stand h12 v 5 if Red 7 >= 16 - 4*dr
-1	Stand h12 v 6 if Red 7 >= 16 - 3*dr
-1	Stand h13 v 2 if Red 7 >= 16 - 3*dr
-2	Stand h13 v 3 if Red 7 >= 16 - 4*dr
4	Stand h15 v T if Red 7 >= 16 + 2*dr
0	Stand h16 v T if Red 7 >= 16 - 2*dr = 2*dp
5	Stand h16 v 9 if Red 7 >= 16 + 3*dr
4	Stand h16 v A, H17 if Red 7 >= 16 + 2*dr
4	Double A2 v 4 if Red 7 >= 16 + 2*dr
3	Double A2 v 3 if Red 7 >= 16 + dr
5	Double A5 v 3 if Red 7 >= 16 + 3*dr
2	Double A6 v 2 if Red 7 >= 16
2*	Double A7 v 2 if Red 7 >= 16
2*	Stand Soft 18 v A if Red 7 >= 16
2*	Double A8 v 6 if Red 7 >= 16
2	Double A8 v 5 if Red 7 >= 16

Red 7 True Count Index	
4	Double A8 v 4 if Red 7 >= 16 + 2*dr
5	Double A8 v 3 if Red 7 >= 16 + 3*dr
5	Double A9 v 6 if Red 7 >= 16 + 3*dr
5	Double A9 v 5 if Red 7 >= 16 + 3*dr
5	Split 2,2 v 8 DAS if Red 7 >= 16 + 3*dr
3	Split 4,4 v 4 DAS if Red 7 >= 16 + dr
3	Split 7,7 v 8 DAS if Red 7 >= 16 + dr
7	*Do NOT split 8,8 v T, DAS if Red 7 >= 16 + 5*dr*
4	Split 9,9 v 7 DAS if Red 7 >= 16 + 2*dr
3	Split 9,9 v A DAS, S17 if Red 7 >= 16 + dr
2	Split 9,9 v A DAS, H17 if Red 7 >= 16
5	Split T,T v 6 if Red 7 >= 16 + 3*dr
5.3	Split T,T v 5 if Red 7 >= 16 + 3.3*dr
5	Split 3,3 v 3 NDAS if Red 7 >= 16 + 3*dr
2	Split 6,6 v 2 NDAS if Red 7 >= 16
5	*Do NOT split 8,8 v T, NDAS if Red 7 >= 16 + 3*dr*
4	Split 9,9 v A NDAS, S17 if Red 7 >= 16 + 2*dr
3	Split 9,9 v A NDAS, H17 if Red 7 >= 16 + dr
2	Late Surrender h15 v A, S17 if Red 7 >= 16
3	Late Surrender h14 v T if Red 7 >= 16 + dr
3	Late Surrender h15 v 9 if Red 7 >= 16 + dr
5	Late Surrender h16 v 8 if Red 7 >= 16 + 3*dr
2	Late Surrender 8,8 v T if Red 7 >= 16
2	Late Surrender 7,7 v T if Red 7 >= 16
2	*Late Surrender h17 v A, H17 if Red 7 <= 16*
4	Late Surrender h14 v A, H17 if Red 7 >= 16 + 2*dr
2	*Late Surrender 8,8 v A, H17 if Red 7 <= 16*
3	Late Surrender 7,7 v A, H17 if Red 7 >= 16 + dr

* h9 v 2 double, h11 v A S17 double, A7 v 2 double, soft 18 v A S17 stand, and A8 v 6 S17 double have indices of +1 but are rounded up to +2 in table above.

Shifted Red 7 Running Count

rc = Red 7 running count
tc = 2 + (rc - 2*n) / dr *
n = number of decks
dr = decks remaining
Let src = Shifted Red 7 running count = rc - 2*n
At the beginning of the shoe, rc = 0 and so src = -2*n:
So at the beginning of the shoe start the src at -2*n, n = # of decks
then

tc = 2 + (src) / dr
where src = rc - 2*n

"n" Decks
(1) Start src at -2*n
(2) src = rc - 2*n
(3) tc = 2 + (src) / dr

Units Bet = (tc - 1) (Exhibit F1)

True Count	Units Bet
2	1
3	2
4	3
5	4

Units Bet = 1 + (src/dr)

One Deck, n = 1:
(1) Start src at -2*n = -2
(2) src = rc - 2
(3) tc = 2 + (src) / dr

Two Decks, n = 2:
(1) Start src at -2*n = -4
(2) src = rc - 4
(3) tc = 2 + (src) / dr

Six Decks, n = 6:
(1) Start src at -2*n = -12
(2) src = rc - 12
(3) tc = 2 + (src) / dr

Eight Decks, n = 8:
(1) Start src at -2*n = -16
(2) src = rc - 16
(3) tc = 2 + (src) / dr

tc = 2 + (rc - 2*n) / dr
rc = 2*n + (tc - 2) * dr

tc	rc
-1	2*n - 3*dr
0	2*n - 2*dr
1	2*n - dr
2	2*n
3	2*n + dr
4	2*n + 2*dr
5	2*n + 3*dr
6	2*n + 4*dr

src = rc - 2*n
tc = 2 + (src) / dr
src = (tc - 2) * dr

tc	src
-1	- 3*dr
0	- 2*dr
1	- dr
2	0
3	dr
4	2*dr
5	3*dr
6	4*dr

** Reference:*
http://www.blackjackforumonline.com/content/membr1.htm
*tc = 2.0 + (rc - 2*n) / dr where tc = true count, rc = Red 7 running count, n = number of decks, dr = decks remaining, dp = decks played*
SIX DECK UNBALANCED RED-7 RUNNING COUNT CONVERSION TO EQUIVALENT HI-LO BALANCED TRUE COUNT AND SENSITIVITY OF TRUE COUNT TO ERRORS IN ESTIMATING DECKS REMAINING
By Conrad Membrino
(From *Blackjack Forum* Vol. XVII #4, Winter 1997)

Shifted Red 7 Running Count

Six Decks

Playing and Strategy Charts using Shifted Running Count

rc = Red 7 running count
n = number of decks
src = shifted running count = rc - 2*n

Six Decks, n = 6: start count at beginning of shoe at -2*n = -12 *

src = rc - 12

Suggested Bet = (tc - 1) units = [1 + (src/dr)] units

Six Decks
Red 7 running count
*rc = 12 + (tc - 2) * dr*

true count	*decks played* 2	3	4	Suggested Units Bet
2	12	***12***	12	1
3	16	***15***	14	2
4	20	***18***	16	3
5	24	***21***	18	4 (max)

Read down Decks Played Column for betting

Six Decks
Red 7 running count
*rc = 12 + (tc - 2) * dr*

true count	*decks played* 2	3	4	rc
2	12	***12***	12	12
3	16	***15***	14	12 + dr
4	20	***18***	16	12 + 2*dr
5	24	***21***	18	12 + 3*dr

Read across True Count Row for playing strategy variations

Six Decks
Shifted Red 7 running count
*src = (tc - 2) * dr*

true count	*decks played* 2	3	4	Suggested Units Bet
2	0	***0***	0	1
3	4	***3***	2	2
4	8	***6***	4	3
5	12	***9***	6	4 (max)

Read down Decks Played Column for betting

Six Decks
Shifted Red 7 running count
*src = (tc - 2) * dr*

true count	*decks played* 2	3	4	src
2	0	***0***	0	0
3	4	***3***	2	dr
4	8	***6***	4	2*dr
5	12	***9***	6	3*dr

Read across True Count Row for playing strategy variations

* Alternately, the count may be started at zero at the beginning of the shoe and the ODP of -3, 0, 3 and 6 (corresponding to a true count of -1) may be used to determine when to leave the table. Once the running count reaches 12, then the shifted running count can be calculated by subtracting 12 from the running count, src = rc - 12, and the src can then be used for the rest of the shoe according to above table or formula.

Shifted Red 7 Running Count

Six Decks

Six Decks

Table of SHIFTED Running Counts

SHIFTED Red 7 running count for 6 deck game

src = (tc - 2) * dr where src = rc - 12

Six deck Shifted rc	true count	decks played (dp) 1	2	3	4	5	Units Bet
-3*dr	*-1*	-15	-12	-9	-6	-3	0
-2*dr	*0*	-10	-8	-6	-4	-2	0
-dr	*1*	-5	-4	-3	-2	-1	0 or 1
0	*2*	0	0	***0***	0	0	1
dr	*3*	5	4	***3***	2	1	2
2*dr	*4*	10	8	***6***	4	2	3
3*dr	*5*	15	12	***9***	6	3	4 (max)
4*dr	*6*	20	16	12	8	4	4 (max)

Read down Decks Played Column for betting

Read across True Count Row for playing strategy variations

For n = 6 decks:

tc = 2 + (rc - 2*n) / dr

src = rc - 2*n

tc = 2 + (rc - 12) / dr

src = rc - 12

tc = 2 + (src / dr) and src = (tc - 2) * dr

Units Bet = (tc - 1) = 1 + (src / dr)

Shifted Red 7 Running Count

Eight Decks

Playing and Strategy Charts using Shifted Running Count

rc = Red 7 running count
n = number of decks
src = shifted running count = rc - 2*n

Eight Decks, n = 8: start count at beginning of shoe at -2*n = -16 *

src = rc - 16

Suggested Bet = (tc - 1) units = [1 + (src/dr)] units

Eight Decks
Red 7 running count
*rc = 16 + (tc - 2) * dr*

true count	*decks played* 2	4	6	Suggested Units Bet
2	16	***16***	16	1
3	22	***20***	18	2
4	-	***24***	20	3
5	-	***28***	22	4 (max)

Read down Decks Played Column for betting

Eight Decks
Red 7 running count
*rc = 16 + (tc - 2) * dr*

true count	*decks played* 2	4	6	**rc**
2	16	***16***	16	16
3	22	***20***	18	16 + dr
4	-	***24***	20	16 + 2*dr
5	-	***28***	22	16 + 3*dr

Read across True Count Row for playing strategy variations

Eight Decks
Shifted Red 7 running count
*src = (tc - 2) * dr*

true count	*decks played* 2	4	6	Suggested Units Bet
2	0	***0***	0	1
3	6	***4***	2	2
4	-	***8***	4	3
5	-	***12***	6	4 (max)

Read down Decks Played Column for betting

Eight Decks
Shifted Red 7 running count
*src = (tc - 2) * dr*

true count	*decks played* 2	4	6	**src**
2	0	***0***	0	0
3	6	***4***	2	dr
4	-	***8***	4	2*dr
5	-	***12***	6	3*dr

Read across True Count Row for playing strategy variations

* Alternately, the count may be started at zero at the beginning of the shoe and the ODP of -6, -3, 0, 3, 6 and 9 (corresponding to a true count of -1) may be used to determine when to leave the table. Once the running count reaches 16, then the shifted running count can be calculated by subtracting 16 from the running count, src = rc - 16, and the src can then be used for the rest of the shoe according to above table or formula.

Shifted Red 7 Running Count

Eight Decks

Eight Decks

Table of SHIFTED Running Counts

SHIFTED Red 7 running count for 8 deck game

src = (tc - 2) * dr where src = rc - 16

Six deck Shifted rc	*true count*	2	4	6	7	Units Bet
-3*dr	*-1*	-	-12	-6	-3	0
-2*dr	*0*	-	-8	-4	-2	0
-dr	*1*	-	-4	-2	-1	0 or 1
0	*2*	0	***0***	0	0	1
dr	*3*	6	***4***	2	1	2
2*dr	*4*	-	***8***	4	2	3
3*dr	*5*	-	***12***	6	3	4 (max)
4*dr	*6*	-	16	8	4	4 (max)

Read down Decks Played Column for betting

Read across True Count Row for playing strategy variations

For n = 8 decks:

tc = 2 + (rc - 2*n) / dr
src = rc - 2*n

tc = 2 + (rc - 16) / dr
src = rc - 16

tc = 2 + (src / dr)   and   src = (tc - 2) * dr
Units Bet = (tc - 1) = 1 + (src / dr)

Shifted Red 7 Strategy Changes

src = rc - 2*n

n = # decks, rc = Red 7 running count, src = shifted Red 7 running count = rc - 2*n

Red 7 True Count Index	
3	Insure if src >= dr
2	Double h8 v 6 if src >= 0
4	Double h8 v 5 if src >= 2*dr
2*	Double h9 v 2 if src >= 0
4	Double h9 v 7 if src >= 2*dr
4	Double h10 v T if src >= 2*dr
4	Double h10 v A, S17 if src >= 2*dr
3	Double h10 v A, H17 if src >= dr
2*	Double h11 v A, S17 if src >= 0
3.3	Stand h12 v 2 if src >= 1.3*dr
2	Stand h12 v 3 if src >= 0
0	Stand h12 v 4 if src >= -2*dr
-2	Stand h12 v 5 if src >= -4*dr
-1	Stand h12 v 6 if src >= -3*dr
-1	Stand h13 v 2 if src >= -3*dr
-2	Stand h13 v 3 if src >= -4*dr
4	Stand h15 v T if src >= 2*dr
0	Stand h16 v T if src >= -2*dr
5	Stand h16 v 9 if src >= 3*dr
4	Stand h16 v A, H17 if src >= 2*dr
4	Double A2 v 4 if src >= 2*dr
3	Double A2 v 3 if src >= dr
5	Double A5 v 3 if src >= 3*dr
2	Double A6 v 2 if src >= 0
2*	Double A7 v 2 if src >= 0
2*	Stand Soft 18 v A if src >= 0
2*	Double A8 v 6 if src >= 0
2	Double A8 v 5 if src >= 0

Red 7 True Count Index	
4	Double A8 v 4 if src >= 2*dr
5	Double A8 v 3 if src >= 3*dr
5	Double A9 v 6 if src >= 3*dr
5	Double A9 v 5 if src >= 3*dr
5	Split 2,2 v 8 DAS if src >= 3*dr
3	Split 4,4 v 4 DAS if src >= dr
3	Split 7,7 v 8 DAS if src >= dr
7	*Do NOT split 8,8 v T, DAS if src >= 5*dr*
4	Split 9,9 v 7 DAS if src >= 2*dr
3	Split 9,9 v A DAS, S17 if src >= dr
2	Split 9,9 v A DAS, H17 if src >= 0
5	Split T,T v 6 if src >= 3*dr
5.3	Split T,T v 5 if src >= 3.3*dr
5	Split 3,3 v 3 NDAS if src >= 3*dr
2	Split 6,6 v 2 NDAS if src >= 0
5	*Do NOT split 8,8 v T, NDAS if src >= 3*dr*
4	Split 9,9 v A NDAS, S17 if src >= 2*dr
3	Split 9,9 v A NDAS, H17 if src >= dr
2	Late Surrender h15 v A, S17 if src >= 0
3	Late Surrender h14 v T if src >= dr
3	Late Surrender h15 v 9 if src >= dr
5	Late Surrender h16 v 8 if src >= 3*dr
2	Late Surrender 8,8 v T if src >= 0
2	Late Surrender 7,7 v T if src >= 0
2	*Late Surrender h17 v A, H17 if src <= 0*
4	Late Surrender h14 v A, H17 if src >= 2*dr
2	*Late Surrender 8,8 v A, H17 if src <= 0*
3	Late Surrender 7,7 v A, H17 if src >= dr

* h9 v 2 double, h11 v A S17 double, A7 v 2 double, soft 18 v A S17 stand, and A8 v 6 S17 double have indices of +1 but are rounded up to +2 in table above.

Shifted Red 7 Running Count
Summary

src = Shifted Red 7 Running Count

src = rc - 2*n
src = (tc - 2) * dr
tc = 2 + (src/dr)

<u>Betting:</u>
units bet = (tc - 1) = 1 + src/dr (six or eight decks)
units bet = src + 2: 0 < dp < 1 (two decks)
units bet = src + 3: 1 < dp < 1.5 (two decks)

<u>Playing Strategy Change:</u>
src >= (IdxA - 2) * dr
(src + k*(6mAc)) >= (IdxB - 2) * dr
If k $\neq$ 0 then IdxB is not necessarily equal to IdxA

(1) The Shifted Red 7 running count is started at -2*n at the beginning of the shoe, where n = number of decks.
(2a) Six or Eight decks: units bet is one plus the shifted running count divided by decks remaining, i.e. units bet = 1 + src/dr.
(2b) Two decks: units bet = src + 2 for 0 < dp < 1 and units bets = src + 3 for 1 < dp < 1.5.
(3) If a playing strategy variation has a true count index of “Idx”, then the strategy change is made if the shifted running count is greater than or equal to the (index minus two) times the decks remaining, i.e., if src >= (Idx – 2)*dr, then make the playing strategy change.
(4) The Six minus Ace, (6mAc), side count is covered in the *Red 7 + k*(6mAc)* paper. If the (6mAc) is kept, then the strategy change is made if src + k*(6mAc) >= (Idx – 2)*dr, where “k” is a constant which varies by playing strategy situation and Idx varies with "k".
(5) Playing Strategy Changes are made if (src + k*(6mAc)) >= (IdxB - 2)*dr. Since src = (rc - 2*n), then if the un-shifted Red 7 running count, rc, is used playing strategy changes are made if (rc + k*(6mAc)) >= 2*n + (IdxB - 2)*dr where n = number or decks.

<u>Examples:</u>

	Six Decks: src = rc - 12		Two Decks: src = rc - 4	
Situation	k, Idx	Decision	k, Idx	Decision
h12 v 2	-1, 3	Stand if (src - (6mAc)) >= dr	-1, 3.3	Stand if (src - (6mAc)) >= 1.3*dr
h12 v 3	-1, 2	Stand if (src - (6mAc)) >= 0	-1, 2	Stand if (src - (6mAc)) >= 0
T,T v 5	0, 5.3	Split if src >= 3.3*dr	0, 5	Split if src >= 3*dr
T,T v 6	0, 5	Split if src >= 3*dr	0, 5	Split if src >= 3*dr
h15 v T	0, 4	Stand if src >= 2*dr	0, 4	Stand if src >= 2*dr
Insurance	-1, 2.6	Insure if src - (6mAc) >= 0.6*dr	-1, 2.4	Insure if src - (6mAc) >= 0.4*dr
h16 v T	-2, 0	Stand if src - 2*(6mAc) >= -2*dr	-2, 0	Stand if src - 2*(6mAc) >= -2*dr
h16 v 9	-2, 3	Stand if src - 2*(6mAc) >= dr	-2, 3	Stand if src - 2*(6mAc) >= dr
h16 v 8	-2, 5	Stand if src - 2*(6mAc) >= 3*dr	-2, 5	Stand if src - 2*(6mAc) >= 3*dr
h16 v 7	-2, 5	Stand if src - 2*(6mAc) >= 3*dr	-2, 6	Stand if src - 2*(6mAc) >= 4*dr
Over 13, 2 units	-2, 4	Two unit Over 13 bet if src - 2*(6mAc) >= 2*dr	-2, 4	not offered with two decks
Over 13, 4 units	-2, 5	Four unit Over 13 bet if src - 2*(6mAc) >= 3*dr	-2, 5	not offered with two decks

See Exhibit H1 in this paper and Exhibit E2, Red 7 + k*(6mAc) for exact indices, AACpTCp and Correlation Coefficients for two and six decks for these playing strategy changes.

Two Deck Suggested True Count Betting with Floating Advantage

Blackjack Forum, March 1989

Suggested Bet: maximum bet = 6

X	0 < dp < 1.0		1.0 < dp < 1.5	
True Count	Y1	Y1 = 2*(X -1)	Y2	Y2 = 1.35*X + 0.625
1	1	1	2	1.975
2	2	2	3.25	3.325
3	4	4	4.75	4.675
4	6	6	6	6.025
>= 5	6	6	6	6

SLOPE(Y1,X) = m	2.00	SLOPE(Y2,X) = m	1.35
INTERCEPT(Y1,X) = b	-2.00	INTERCEPT(Y2,X) = b	0.625
Y1 = m*X + b = 2*X + (-2) = 2*(X - 1)		Y2 = m*X + b = 1.35*X + 0.625	

Two Deck suggested betting
src = rc – 4, tc = 2 + (src/dr)
<u>0 < dp < 1:</u>
units bet = 2*(tc - 1), max bet = 6
<u>1 < dp < 1.5:</u> (floating advantage)
units bet = 1.35*tc + 0.625, max bet = 6

Shifted Red 7 Running Count
Two Deck Estimated Betting

Two Deck suggested betting
src = rc – 4, tc = 2 + (src/dr)
0 < dp < 1:
units bet = 2*(tc - 1), max bet = 6
1 < dp < 1.5:   (floating advantage)
units bet = 1.35*tc + 0.625, max bet = 6

Two Deck approximate betting
src = rc – 4, tc = 2 + (src/dr)
0 < dp < 1:
units bet = 2 + src, max bet = 6
1 < dp < 1.5:   (floating advantage)
units bet = 3 + src, max bet = 6

Two Decks: 0 < dp < 1.0

(1) dp	(2) = 2.0 - (1) dr	(3) src	(4) = (3)/(2) tsrc = src/dr	(5) = (4) + 2.0 true count	(6)=2*((5)-1.0) suggested bet	(7) = (3) + 2.0 approx. bet	(8) = (7) - (6) over betting
0.5	1.5	0	0.0	2.0	2.0	2.0	0.0
0.5	1.5	1	0.7	2.7	3.3	3.0	-0.3
0.5	1.5	2	1.3	3.3	4.7	4.0	-0.7
0.5	1.5	3	2.0	4.0	6.0	5.0	-1.0
0.5	1.5	4	2.7	4.7	6.0	6.0	0.0
0.5	1.5	5	3.3	5.3	6.0	6.0	0.0
0.5	1.5	6	4.0	6.0	6.0	6.0	0.0

Two Decks: 1.0 < dp < 1.5: Floating Advantage

(1) dp	(2) = 2.0 - (1) dr	(3) src	(4) = (3)/(2) tsrc = src/dr	(5) = (4) + 2.0 true count	(6)=Float Adv* suggested bet	(7) = (3) + 3.0 approx. bet	(8) = (7) - (6) over betting
1.250	0.750	-1	-1.3	0.7	1.5	2.0	0.5
1.250	0.750	0	0.0	2.0	3.3	3.0	-0.3
1.250	0.750	1	1.3	3.3	5.1	4.0	-1.1
1.250	0.750	2	2.7	4.7	6.0	5.0	-1.0
1.250	0.750	3	4.0	6.0	6.0	6.0	0.0
1.250	0.750	4	5.3	7.3	6.0	6.0	0.0
1.250	0.750	5	6.7	8.7	6.0	6.0	0.0
1.250	0.750	6	8.0	10.0	6.0	6.0	0.0

* Floating Advantage Bet = 1.35*tc + 0.625 = 1.35*(col 5) + 0.625, maximum bet = 6

Shifted Red 7 Running Count
Overall Summary

Six or Eight Deck back counted game:

src = rc - 2*n, tc = 2 + (src/dr)
Units bet = 1 + src/dr, max bet = 4 units
Playing Strategy Change, no (6mAc) count, if:
src >= (IdxA - 2) * dr
Playing Strategy Change, with (6mAc) count, if:
(src + k*(6mAc)) >= (IdxB - 2) * dr
If k ≠ 0 then IdxB is not necessarily equal to IdxA (i)

Two Deck play all game:

src = rc - 4, tc + 2 + (src/dr)
0 < dp < 1: units bet = 2 + src, max bet = 6
1 < dp < 1.5: units bet = 3 + src, max bet = 6
Playing Strategy Change, no (6mAc) count, if:
src >= (IdxA - 2) * dr
Playing Strategy Change, with (6mAc) count, if:
(src + k*(6mAc)) >= (IdxB - 2) * dr
If k ≠ 0 then IdxB is not necessarily equal to IdxA (i)

(i) Truing the Red 7 count, "Exhibit K3":
In the infinite deck case, Idx = k*(SD/CC)
where k = constant for any given playing strategy change, being a function of the EoR for that playing strategy situation.

$$\frac{IdxB}{IdxA} = \frac{(SD:B/CC:B)}{(SD:A/CC:A)} = \frac{(SD:B/SD:A)}{(CC:B/CC:A)}$$

So for the infinite deck case, IdxB and IdxA would be equal only if the ratio of the standard deviations between the two counts were equal to the ratio of the correlation coefficients between the two counts for the particular playing strategy variation being considered.

Examples where Red 7 and Red 7 + k*(6mAc) Indices are almost equal

Red 7 Indicies: Exhibits G2 and H2 of this paper

Situation	1	2	6	8	Infinite
Split 9,9 v 7: DAS	4.19	3.70	3.37	3.33	3.21
rounded	5	4	4	4	4
Split 9,9 v A: DAS	-0.04	1.65	2.35	2.46	2.85
rounded	0	2	3	3	3
Split 9,9 v A: DAS, H17	-1.39	0.43	1.58	1.72	2.14
rounded	-1	1	2	2	2

Red 7 + (6mAc) Indicies: Exhibits F1 and F2 of Red 7 + k*(6mAc) paper

Situation	1	2	6	8	Infinite
Split 9,9 v 7: DAS	4.69	4.16	3.81	3.76	3.63
rounded	5	5	4	4	4
Split 9,9 v A: DAS	-0.92	1.50	2.63	2.79	3.35
rounded	0	2	3	3	4
Split 9,9 v A: DAS, H17	-2.48	0.07	1.70	1.90	2.50
rounded	-1	0	2	2	3

Exhibit H2 of this paper

SD(Red 7)	0.8979
Split 9,9 v 7: DAS	
Count	Red 7
k (# decks) =	infinite
Cor Coef	66.40%
Index, Idx	**3.21**
Split 9,9 v A: DAS	
Count	Red 7
k (# decks) =	infinite
Cor Coef	78.40%
Index, Idx	**2.85**
Split 9,9 v A: DAS, H17	
Count	Red 7
k (# decks) =	infinite
Cor Coef	73.19%
Index, Idx	**2.14**

Exh F2, R7 + k*(6mAc) paper

SD(R7 + (6mAc))	1.1259
Split 9,9 v 7: DAS	
Count	R7 + (6mAc)
k (# decks) =	infinite
Cor Coef	73.50%
Index, Idx	**3.63**
Split 9,9 v A: DAS	
Count	R7 + (6mAc)
k (# decks) =	infinite
Cor Coef	83.59%
Index, Idx	**3.35**
Split 9,9 v A: DAS, H17	
Count	R7 + (6mAc)
k (# decks) =	infinite
Cor Coef	78.84%
Index, Idx	**2.50**

	(1) Red 7	(2) R7 + (6mAc)	(3) = (2)/(1) Ratio
SD	0.8979	1.1259	1.2540
CC	66.40%	73.50%	1.1070
SD/CC	n/a	n/a	1.1327
Index	3.2066	3.6322	1.1327

	Red 7	R7 + (6mAc)	Ratio
SD	0.8979	1.1259	1.2540
CC	78.40%	83.59%	1.0663
SD/CC	n/a	n/a	1.1760
Index	2.8524	3.3545	1.1760

	Red 7	R7 + (6mAc)	Ratio
SD	0.8979	1.1259	1.2540
CC	73.19%	78.84%	1.0772
SD/CC	n/a	n/a	1.1641
Index	2.1446	2.4965	1.1641

Standard Deviation of Red 7 and Red 7 + k*(6mAc)

Card	X1 Red 7	(6mAc)	**X2** R7+(6mAc)	
Red 2	1	0	1	
Black 2	1	0	1	
Red 3	1	0	1	
Black 3	1	0	1	
Red 4	1	0	1	
Black 4	1	0	1	
Red 5	1	0	1	
Black 5	1	0	1	
Red 6	1	1	2	
Black 6	1	1	2	
Red 7	1	0	1	
Black 7	0	0	0	
Red 8	0	0	0	
Black 8	0	0	0	
Red 9	0	0	0	
Black 9	0	0	0	
Red 10	-1	0	-1	
Black 10	-1	0	-1	
Red J	-1	0	-1	
Black J	-1	0	-1	
Red Q	-1	0	-1	
Black Q	-1	0	-1	
Red K	-1	0	-1	
Black K	-1	0	-1	
Red A	-1	-1	-2	
Black A	-1	-1	-2	
Total	1.0000	0.0000	1.0000	
mu = mean	0.0385	0.0000	0.0385	
u = mu*52	2.0	0.0	2.0	u = unbalance per deck
STDEVP(X)	0.8979	0.3922	1.1259	

Comparison of Infinite Deck Correlation Coefficients
of Hi-Low and Red 7

Situation	(1) Infinite Deck Correlation Coefficients (CC): Red 7	(2) Infinite Deck Correlation Coefficients (CC): Hi-Low	(3) Infinite Deck Hi-Low Playing Strategy Index	(4) = (3) - 1.0 Initial Units Bet at Index 1 to 4 units bet = (tc - 1)	(5) = (4) * 2.0 if dbl or split Units Bet double & splits at Index	(6) Hand Freq per 100,000 Hands (A)	(7) = (3) Rounded Infinite Deck Hi-Low True Count: Index >= 2: back counting	(8) 4.5 of 6 decks dealt % of hands at Hi-Low true count = "t"	(9) = (6) * (8) Hand Frequency at Hi-Low true count = "t"	(10) = (5) * (9) Total Units Bet at Index	(11) = (10) / Tot (10) Judgmental Relative Weights #1 (Play only)	(12) Judgmental Relative Weights #2 (Play & Bet)
betting, S17, DAS, no LS	96.8%	96.5%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	50.0%
Insurance	77.1%	76.0%	3.33	2.33	2.33	7,692	3	4.0%	309	720	29.7%	14.9%
h8 v 5	90.5%	93.5%	3.56	2.56	5.12	179	3	4.0%	7	37	1.5%	0.8%
h8 v 6	83.1%	85.8%	1.61	1.00	2.00	179	2	7.0%	13	25	1.0%	0.5%
h9 v 2	83.9%	81.2%	0.89	1.00	2.00	271	2	7.0%	19	38	1.6%	0.8%
h9 v 7	84.4%	85.3%	3.48	2.48	4.97	271	3	4.0%	11	54	2.2%	1.1%
h10 v T	86.0%	81.1%	3.62	2.62	5.23	1,181	3	4.0%	47	248	10.2%	5.1%
h10 v A	95.4%	93.7%	3.61	2.61	5.22	215	3	4.0%	9	45	1.9%	0.9%
h11 v A	83.2%	82.2%	1.42	1.00	2.00	249	2	7.0%	18	35	1.4%	0.7%
h12 v 2	66.8%	63.8%	3.17	2.17	2.17	750	3	4.0%	30	65	2.7%	1.3%
h12 v 3	73.4%	70.9%	1.36	1.00	1.00	750	2	7.0%	53	53	2.2%	1.1%
h15 v T	77.1%	76.7%	3.87	2.87	2.87	3,530	3	4.0%	142	407	16.8%	8.4%
h16 v T	57.1%	55.8%	0.08	1.00	1.00	3,530	2	7.0%	249	249	10.3%	5.1%
h16 v 9	45.4%	52.8%	4.23	3.23	3.23	960	4	2.2%	21	69	2.8%	1.4%
A2 v 4	64.3%	65.6%	3.81	2.81	5.61	92	3	4.0%	4	21	0.9%	0.4%
A3 v 4	67.1%	70.3%	2.45	1.45	2.91	92	2	7.0%	6	19	0.8%	0.4%
A5 v 3	33.1%	26.8%	4.97	3.97	7.94	92	4	2.2%	2	16	0.7%	0.3%
A6 v 2	32.6%	28.0%	1.50	1.00	2.00	92	2	7.0%	6	13	0.5%	0.3%
A7 v 2	41.4%	38.2%	0.23	1.00	2.00	92	2	7.0%	6	13	0.5%	0.3%
soft 18 v A	48.6%	49.6%	1.36	1.00	1.00	99	2	7.0%	7	7	0.3%	0.1%
A8 v 6	80.4%	80.3%	0.81	1.00	2.00	92	2	7.0%	6	13	0.5%	0.3%
A8 v 5	85.2%	85.5%	1.48	1.00	2.00	92	2	7.0%	6	13	0.5%	0.3%
A8 v 4	77.3%	74.4%	3.37	2.37	4.73	92	3	4.0%	4	17	0.7%	0.4%
A8 v 3	73.4%	70.7%	5.38	4.00	8.00	92	5	1.3%	1	9	0.4%	0.2%
A9 v 6	90.6%	92.0%	4.27	3.27	6.53	92	4	2.2%	2	13	0.5%	0.3%
A9 v 5	94.7%	96.1%	4.79	3.79	7.59	92	4	2.2%	2	15	0.6%	0.3%
4.4 v 4 DAS	79.6%	80.9%	3.17	2.17	4.34	38	3	4.0%	2	7	0.3%	0.1%
9.9 v 7 DAS	66.4%	63.3%	3.29	2.29	4.57	43	3	4.0%	2	8	0.3%	0.2%
9.9 v A DAS	78.4%	78.5%	2.78	1.78	3.56	29	2	7.0%	2	7	0.3%	0.2%
TT v 6	89.8%	91.4%	4.50	3.50	7.00	727	4	2.2%	16	113	4.7%	2.3%
TT v 5	93.9%	95.4%	5.09	4.00	8.00	727	5	1.3%	9	74	3.0%	1.5%
Avg #1: Play Only	**76.0%**	**75.1%**	n/a	n/a	n/a	22,432	n/a	n/a	1,011	2,423	100.0%	100.0%
Avg #2: Betting & Play	**86.4%**	**85.8%**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes

(A) BJ Attack, 3rd Edition, Table 7.1: Hand Frequencies Based on 100,000 playable hands (A9 v 5 and A9 v 6 estimated)

Playing strategy situations were chosen for true counts of 2, 3, 4 and 5 since for shoe games, these are the true counts of interest for playing strategy variations.

Column (7) Hi-Low Indices = Column (3) indices rounded down subject to index >= 2 since back counting

Red 7 is *slightly* more *powerful* than the Hi-Low as measured by the weighted Correlation Coefficients for playing and for betting and playing combined.

Calculation of True Count Frequencies

*4.5 out of Six Decks Dealt **

Hi-Low True Count >= 0		tc = t	
True Count	# hands	tc = (t-1)	% total
0	102,204,912	n/a	41.8%
1	63,530,585	62.2%	26.0%
2	34,479,737	54.3%	14.1%
3	19,630,167	56.9%	8.0%
4	10,847,091	55.3%	4.4%
>= 5	13,979,096	n/a	5.7%
Total	244,671,588		100.0%
5	6,202,367	57.18%	2.5%
6	3,546,513	57.18%	1.4%
7	2,027,896	57.18%	0.8%
8	1,159,551	57.18%	0.5%
9	663,031	57.18%	0.3%
10	379,121	57.18%	0.2%
Tot 5 to10	13,978,480	n/a	5.7%
(>=5) - Tot 5 to10	616		0.0%

* BJ Attack, 3rd Edition, Table 6.12

*5 out of Six Decks Dealt ***

Hi-Low True Count >= 0		tc = t	
True Count	# hands	tc = (t-1)	% total
0	104,953,388	n/a	39.2%
1	66,901,449	63.7%	25.0%
2	38,264,588	57.2%	14.3%
3	22,443,829	58.7%	8.4%
4	12,847,546	57.2%	4.8%
>= 5	22,143,137	n/a	8.3%
Total	267,553,937		100.0%
5	8,363,752	65.10%	3.1%
6	5,444,803	65.10%	2.0%
7	3,544,567	65.10%	1.3%
8	2,307,513	65.10%	0.9%
9	1,502,191	65.10%	0.6%
10	977,926	65.10%	0.4%
Tot 5 to10	22,140,752	n/a	8.3%
(>=5) - Tot 5 to10	2,385		0.0%

** BJ Attack, 3rd Edition, Table 6.16

4.5 out of 6 decks dealt

Hi-Low True Count	% total hands
-10	0.1%
-9	0.1%
-8	0.2%
-7	0.4%
-6	0.7%
-5	1.3%
-4	2.2%
-3	4.0%
-2	7.0%
-1	13.0%
0	41.8%
1	13.0%
2	7.0%
3	4.0%
4	2.2%
5	1.3%
6	0.7%
7	0.4%
8	0.2%
9	0.1%
10	0.1%
Total	100.0%

5 out of 6 decks dealt

Hi-Low True Count	% total hands
-10	0.2%
-9	0.3%
-8	0.4%
-7	0.7%
-6	1.0%
-5	1.6%
-4	2.4%
-3	4.2%
-2	7.2%
-1	12.5%
0	39.2%
1	12.5%
2	7.2%
3	4.2%
4	2.4%
5	1.6%
6	1.0%
7	0.7%
8	0.4%
9	0.3%
10	0.2%
Total	100.0%

Comparison of Hi-Low and Red 7 Indices

The Indices of the Red 7 are almost identical to the Hi-Low critical indices:

Idx = k * (SD / CC)   Exhibit K3

SD of Red 7 is slightly (2.4%) greater than the Hi-Low which tends to increase the Idx of the Red 7 over the Hi-Low. The Red 7 counts an extra card that the Hi-Low doesn't count so the count is more variable as measured by SD and so a Red 7 true count is not "worth as much" as a Hi-Low true count since a given Red 7 true count will occur more often. This tends to decrease the AACpTCp for the Red 7 over the Hi-Low and so increases the Red 7 Idx over the Hi-Low Idx. The increase in the Idx due to greater variability of the Red 7 count is only 2.4% and so when rounded the Idx are almost equal.

For many situations, the CC of the Red 7 is slightly higher than the CC of the Hi-Low. This tends to decease the Idx of the Red 7 as compared to the Hi-Low. Thus when the CC of the Red 7 is greater than the Hi-Low, this tends to cancel some of the increase in the Red 7 Idx due to its higher SD making the Idx almost equal.

	Infinite Decks						Exhibit D1
Situation	Hi-Low			Red 7			Judg. Weights
	CC	AACpTCp	Index	CC	AACpTCp (1)	Index (2)	#1 (Play only)
Insurance	76.0%	2.31%	3.33	77.1%	2.29%	3.36	29.7%
h8 v 5	93.5%	1.89%	3.56	90.5%	1.79%	3.77	1.5%
h8 v 6	85.8%	1.74%	1.61	83.1%	1.64%	1.70	1.0%
h9 v 2	81.2%	1.49%	0.89	83.9%	1.51%	0.89	1.6%
h9 v 7	85.3%	1.94%	3.48	84.4%	1.88%	3.61	2.2%
h10 v T	81.1%	0.94%	3.62	86.0%	0.97%	3.49	10.2%
h10 v A	93.7%	2.64%	3.61	95.4%	2.63%	3.63	1.9%
h11 v A	82.2%	2.39%	1.42	83.2%	2.36%	1.44	1.4%
h12 v 2	63.8%	1.24%	3.17	66.8%	1.27%	3.10	2.7%
h12 v 3	70.9%	1.36%	1.36	73.4%	1.38%	1.35	2.2%
h15 v T	76.7%	0.93%	3.87	77.1%	0.91%	3.95	16.8%
h16 v T	55.8%	0.76%	0.08	57.1%	0.75%	0.08	10.3%
h16 v 9	52.8%	0.80%	4.23	45.4%	0.67%	5.04	2.8%
A2 v 4	65.6%	1.16%	3.81	64.3%	1.11%	3.97	0.9%
A3 v 4	70.3%	0.88%	2.45	67.1%	0.82%	2.64	0.8%
A5 v 3	26.8%	0.33%	4.97	33.1%	0.40%	4.12	0.7%
A6 v 2	28.0%	0.44%	1.50	32.6%	0.50%	1.31	0.5%
A7 v 2	38.2%	0.87%	0.23	41.4%	0.92%	0.22	0.5%
soft 18 v A	49.6%	0.53%	1.36	48.6%	0.51%	1.43	0.3%
A8 v 6	80.3%	2.02%	0.81	80.4%	1.97%	0.83	0.5%
A8 v 5	85.5%	2.27%	1.48	85.2%	2.21%	1.52	0.5%
A8 v 4	74.4%	2.14%	3.37	77.3%	2.17%	3.32	0.7%
A8 v 3	70.7%	2.02%	5.38	73.4%	2.04%	5.31	0.4%
A9 v 6	92.0%	3.01%	4.27	90.6%	2.89%	4.44	0.5%
A9 v 5	96.1%	3.29%	4.79	94.7%	3.17%	4.98	0.6%
4.4 v 4 DAS	80.9%	1.87%	3.17	79.6%	1.80%	3.30	0.3%
9.9 v 7 DAS	63.3%	1.06%	3.29	66.4%	1.08%	3.21	0.3%
9.9 v A DAS	78.5%	1.35%	2.78	78.4%	1.31%	2.85	0.3%
TT v 6	91.4%	5.24%	4.50	89.8%	5.03%	4.69	4.7%
TT v 5	95.4%	5.70%	5.09	93.9%	5.48%	5.29	3.0%
Weighted Avg	75.1%	1.84%	3.11	76.0%	1.81%	3.16	100.0%

SD:HL = 0.8771
SD:R7 = 0.8979
(Exhibit K3)

AACpTCp = k1 * (CC / SD)

AACpTCp:R7 / AACpTCp:HL =
(CC:R7 / SD:R7) / (CC:HL / SD:HL)

(1) AACpTCp: Red 7
AACpTCp:R7 =
AACpTCp:HL *
(CC:R7 / SD:R7) / (CC:HL / SD:HL)

Idx = k2 * (SD / CC)

Idx:R7 / Idx:HL =
(SD:R7 / CC:R7) / (SD:HL / CC:HL)

(2) Index: Red 7
Idx:R7 =
Idx:HL *
(SD:R7 / CC:R7) / (SD:HL / CC:HL)
Note: Calculated Red 7 infinite deck Indices agree with Indices in Exhibit G1.

	SD	Avg CC
Red 7	0.8979	76.0%
Hi-Low	0.8771	75.1%
Red 7 / HL	1.0238	1.0115
Red 7 / HL: (SD/CC)		1.0121

	Avg Infinite Deck Index
Red 7	3.16
Hi-Low	3.11
Avg (R7 Idx / HL Idx)	1.0163

Exhibit D2 - Comparison of Correlation Coefficients of Hi-Low and Red 7

Sensitivity of Red 7 True Count to Errors in Estimating Decks Played for True Counts of 2, 3, 4 and 5

Notes:

(2) Player overestimated decks played, on average, by 0.75 decks.

*(6) Actual Red 7 running count taken as Hi-Low + 2 * (Actual Decks Played), since two red sevens are expected per deck played on average.*
The result is rounded to the nearest integer since the Red 7 count must be an integer.
This is the most likely value of the Red 7 count corresponding to the given Hi-Low count and number or decks played.

(9) Six Deck Game: Actual tc.R7 = 2 + (rc.R7 - 12) / (dr: actual)

(10) Six Deck Game: Estimated tc.R7 = 2 + (rc.R7 - 12) / (dr: estimated)
Red 7 player will not be doing any division to calculate true counts. Tables given earlier in this paper (calculated from above formula) will be used.

Red 7 is more ***accurate*** than the Hi-Low in estimating true count of 2, 3, 4 and 5.

Six Deck Game

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
decks played (dp)		decks remaining (dr)		Running Counts		Hi-Low True Counts		Red 7 True Counts		**Abs Val (True Count Errors)**	
	Over Est.	Actual	Estimated		Red 7	Actual	Estimated	Actual	Estimated	**Hi-Low**	**Red 7**
Actual	~ 0.75 decks	6 .0 - (1)	6 .0 - (2)	Hi-Low	(5) + (1)*2.0	(5) / (3)	(5) / (4)	2 + ((6)-12)/(3)	2 + ((6)-12)/(4)	AV{(8)-(7)}	AV{(10)-(9)}
1.80	2.50	4.20	3.50	9	13	2.14	2.57	2.24	2.29	0.43	0.05
2.30	3.00	3.70	3.00	9	14	2.43	3.00	2.54	2.67	0.57	0.13
2.70	3.50	3.30	2.50	9	14	2.73	3.60	2.61	2.80	0.87	0.19
3.20	4.00	2.80	2.00	9	15	3.21	4.50	3.07	3.50	1.29	0.43
3.70	4.50	2.30	1.50	9	16	3.91	6.00	3.74	4.67	2.09	0.93
3.80	4.50	2.20	1.50	9	17	4.09	6.00	4.27	5.33	1.91	1.06
4.20	5.00	1.80	1.00	9	17	5.00	9.00	4.78	7.00	4.00	2.22
1.30	2.00	4.70	4.00	12	15	2.55	3.00	2.64	2.75	0.45	0.11
1.80	2.50	4.20	3.50	12	16	2.86	3.43	2.95	3.14	0.57	0.19
2.20	3.00	3.80	3.00	12	16	3.16	4.00	3.05	3.33	0.84	0.28
2.70	3.50	3.30	2.50	12	17	3.64	4.80	3.52	4.00	1.16	0.48
3.20	4.00	2.80	2.00	12	18	4.29	6.00	4.14	5.00	1.71	0.86
3.30	4.00	2.70	2.00	12	19	4.44	6.00	4.59	5.50	1.56	0.91
3.70	4.50	2.30	1.50	12	19	5.22	8.00	5.04	6.67	2.78	1.62
0.80	1.50	5.20	4.50	15	17	2.88	3.33	2.96	3.11	0.45	0.15
1.30	2.00	4.70	4.00	15	18	3.19	3.75	3.28	3.50	0.56	0.22
1.70	2.50	4.30	3.50	15	18	3.49	4.29	3.40	3.71	0.80	0.32
2.20	3.00	3.80	3.00	15	19	3.95	5.00	3.84	4.33	1.05	0.49
2.70	3.50	3.30	2.50	15	20	4.55	6.00	4.42	5.20	1.45	0.78
2.80	3.50	3.20	2.50	15	21	4.69	6.00	4.81	5.60	1.31	0.79
3.20	4.00	2.80	2.00	15	21	5.36	7.50	5.21	6.50	2.14	1.29
Overall Average										**1.33**	**0.64**

Accuracy of Red 7 True Count for Betting
Infinite Deck Assumption

Percentage gain from strategy variation

	Sorted by Idx rounded, AACpTCp			*pa(t) = AACpTCp * (t - Idx), t = true count (A)* True Count					Hand Freq per 100,000
Situation	Idx rounded	Idx	AACpTCp	2	3	4	5	6	Hands (B)
h16 v T	0	(0.0)	0.75%	1.53%	2.28%	3.04%	3.79%	4.55%	3,530
h11 v A	2	1.3	2.36%	1.73%	4.09%	6.44%	8.80%	11.16%	249
A8 v 5	2	1.5	2.21%	1.15%	3.36%	5.56%	7.77%	9.97%	92
A8 v 6	2	0.8	1.98%	2.29%	4.27%	6.24%	8.22%	10.20%	92
h8 v 6	2	1.7	1.64%	0.43%	2.08%	3.72%	5.36%	7.00%	179
h9 v 2	2	0.9	1.50%	1.67%	3.17%	4.68%	6.18%	7.69%	271
h12 v 3	2	1.4	1.38%	0.79%	2.17%	3.54%	4.92%	6.30%	750
A7 v 2	2	0.2	0.91%	1.64%	2.55%	3.46%	4.38%	5.29%	92
soft 18 v A	2	1.2	0.51%	0.39%	0.90%	1.41%	1.91%	2.42%	99
A6 v 2	2	1.4	0.50%	0.30%	0.81%	1.31%	1.81%	2.31%	92
Insurance	3	3.4	2.28%			1.37%	3.65%	5.94%	7,692
4.4 v 4 DAS	3	3.2	1.80%			1.47%	3.27%	5.07%	38
9.9 v A DAS	3	2.8	1.31%		0.32%	1.63%	2.94%	4.25%	29
h12 v 2	3	3.2	1.27%			1.07%	2.34%	3.61%	750
A3 v 4	3	2.7	0.82%		0.26%	1.08%	1.90%	2.73%	92
h10 v A	4	3.5	2.63%			1.44%	4.08%	6.71%	215
A8 v 4	4	3.3	2.17%			1.55%	3.72%	5.89%	92
h9 v 7	4	3.6	1.88%			0.79%	2.66%	4.54%	271
h8 v 5	4	3.7	1.79%			0.45%	2.24%	4.03%	179
A2 v 4	4	3.9	1.11%			0.09%	1.20%	2.31%	92
9.9 v 7 DAS	4	3.3	1.09%			0.78%	1.87%	2.95%	43
h10 v T	4	3.4	0.98%			0.61%	1.59%	2.56%	1,181
h15 v T	4	3.8	0.91%			0.14%	1.05%	1.97%	3,530
7.7 v 8 DAS	4	3.9	0.50%			0.05%	0.55%	1.06%	43
2.2 v 8 DAS	4	3.6	0.47%			0.18%	0.65%	1.13%	43
TT v 5	5	5.3	5.48%					3.67%	727
TT v 6	5	4.8	5.03%				1.17%	6.20%	727
A9 v 5	5	4.9	3.17%				0.25%	3.42%	***92***
A9 v 6	5	4.4	2.90%				1.72%	4.62%	***92***
A8 v 3	5	5.2	2.04%					1.54%	92
h16 v 9	5	5.0	0.67%				0.03%	0.69%	960
A5 v 3	5	4.3	0.39%				0.27%	0.66%	92
Weighted Average Strategy Gain				0.07%	0.13%	0.32%	0.64%	1.02%	100,000
							Number of hands shown above		22,518

Exhibit F1a - Red 7 True Count Betting Accuracy

Accuracy of Red 7 True Count for Betting
Infinite Deck Assumption

Notes:

(A) pa(t) = player's advantage, for given situation, at true count "t" (See Exhibit K5).
pa(t) = AACpTCp * (t - Idx) where t = true count.
Infinite Decks: pa(t) = AACpTCp * t - FDHA and Idx = FDHA / AACpTCp
Note that pa(Idx) = 0, i.e. players advantage at the Index is zero (strategy change just becomes profitable to make),
and for each true count point above the Index, the player's advantage is increased by AACpTCp.

(B) BJ Attack, 3rd Edition, Table 7.1: Hand Frequencies based on 100,000 playable hands (A9 v 5 and A9 v 6 estimated)
Weighted Average Strategy Gain(True Count = "t") = SUMPRODUCT(pa(t) column, Hand Frequency column) / 100,000
Total Hand Frequency of Exhibit D1, col (6) = 22,432. This Exhibit includes 2,2 v 7 DAS for 43 hands and 7,7 v 8 DAS for 43 hands giving a total of 86 more hands and so total hands shown in this Exhibit is 22,518.

Total Players Advantage at true count "t" = tpa(t) = ba(t) + sg(t)
Betting Advantage at true count "t" = ba(t) = AACpTCp * (t - Idx)
Strategy Gain at true count "t" = sg(t) = taken from weighed average above
Suggested units Bet at true count (t) = sb(t)

Count	Red 7
Situation	
k (# decks) =	6
Cor Coef	96.83%
AACpTCp	0.495%
FDHA,"k" dks	0.403%
MDHA,"k" dks	0.403%
MT, "k" dks	-
YI, "k" decks	-
Prop Defl Idx	**0.81**

Betting, S17, DAS, no LS

AACpTCp = 0.495% Idx = 0.81

Suggested Bet directly proportional to total player's advantage

true count	ba(t)	sg(t)	tpa(t)	tpa(t) / tpa(2)	suggested bet
2	0.59%	0.07%	0.66%	1.00	1
3	1.08%	0.13%	1.21%	1.83	2
4	1.58%	0.32%	1.90%	2.87	3
5	2.07%	0.64%	2.71%	4.09	4 (max)
6	2.57%	1.02%	3.59%	5.41	4 (max)

*Note: sb(t) ~= sb(2) * { tpa(t) / tpa(2) }*

Count	Red 7
Situation	Betting, H17, DAS, no LS
k (# decks) =	6
Cor Coef	96.98%
AACpTCp	0.514%
FDHA,"k" dks	0.617%
MDHA,"k" dks	0.617%
MT, "k" dks	-
YI, "k" decks	-
Prop Defl Idx	**1.20**

Betting, S17, DAS, no LS

pa(t) = AACpTCp * (t - Idx)

Red 7	Betting, S17, DAS, no LS
t	pa(t)
0	-0.40%
1	0.09%
2	0.59%
3	1.08%
4	1.58%
5	2.07%
6	2.57%

Betting, H17, DAS, no LS

pa(t) = AACpTCp * (t - Idx)

Red 7	Betting, H17, DAS, no LS	
t	pa(t)	H17 - S17
0	-0.62%	-0.21%
1	-0.10%	-0.19%
2	0.41%	-0.18%
3	0.93%	-0.16%
4	1.44%	-0.14%
5	1.95%	-0.12%
6	2.47%	-0.10%

Extrapolated Average Player's Advantage (pa)
4.5 out of 6 decks dealt
Playing only Red 7 True Count >= 2

X = Red 7 True Count	(A) % of Hands	(B) Y = (A) / (A:prev)	(C) Y:LSL = m*X + b	(D) =(D:prev)*(C) # Hands	(E) tot player's adv. = tpa	(F) =(E) - (E:prev)
2	43.1%	n/a	n/a	10,000	0.66%	n/a
3	24.9%	0.5766	0.5940	5,940	1.21%	0.55%
4	14.5%	0.5825	0.5825	3,460	1.90%	0.69%
5	8.5%	0.5868	0.5709	1,975	2.71%	0.81%
6	4.9%	0.5810	0.5593	1,105	3.59%	0.88%
7	2.7%	0.5435	0.5477	605	4.47%	0.88%
8	1.4%	0.5201	0.5361	324	5.35%	0.88%
9	n/a	n/a	0.5245	170	6.23%	0.88%
10	n/a	n/a	0.5130	87	7.11%	0.88%
11	n/a	n/a	0.5014	44	7.99%	0.88%
12	n/a	n/a	0.4898	21	8.87%	0.88%
Tot / Wtd Avg	100.0%	0.5771	0.5797	23,732		
CORREL(Y,X) = CC		-80.2%				
SLOPE(Y,X) = m		-0.0116				
INTERCEPT(Y,X) = b		0.6288				

(A) Exhibit K13 of Red 7 + k*(6mAc) paper
(E) Exhibit F1a
tpa = total player's advantage = betting gain + strategy gain.
"tpa" for S17, DAS, no LS. "tpa" for true counts 7 to 12 estimated.

Red 7 True Count	(G) =(D) # Hands	(H) % of Hands (G) /Tot (G)	(I) Units Bet	(J) =(G) * (I) Amount Bet	(K) % of Bets (J) /Tot (J)	(L) tot player's adv. = tpa
2	10,000	42.1%	1	10,000	20.2%	0.66%
3	5,940	25.0%	2	11,881	24.0%	1.21%
4	3,460	14.6%	3	10,380	20.9%	1.90%
5	1,975	8.3%	4	7,901	15.9%	2.71%
6	1,105	4.7%	4	4,419	8.9%	3.59%
7	605	2.5%	4	2,420	4.9%	4.47%
8	324	1.4%	4	1,298	2.6%	5.35%
9	170	0.7%	4	681	1.4%	6.23%
10	87	0.4%	4	349	0.7%	7.11%
11	44	0.2%	4	175	0.4%	7.99%
12	21	0.1%	4	86	0.2%	8.87%
Total	23,732	100.0%	n/a	49,588	100.0%	**2.11%**

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet (Input Betting Schedule Here)											
Red 7 "tc"	tot adv	A	B	C	D	E	F	A'	B'	C'	D'	E'	F'
-1	-0.90%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
0	-0.40%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
1	0.09%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
2	0.66%	1	1	1	1	1	0	1	1	1	1	1	0.5
3	1.21%	1	1	2	2	1.8	1	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4 Sch D: bet(t) = (tc - 1), no max Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2) Sch F: bet(t) = (tc - 2), max = 4

	Number of Hands Back Counted					500		Expected Win + k*(Std Dev) = μ + k*σ, k ε {-3,-2,-1,1,2,3}					
Betting Sch	played	Amt Bet	Win	E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	133	149	2.3	1.5%	13.5	6.0	43.4%	(38.2)	(24.7)	(11.2)	15.7	29.2	42.7
B	133	197	3.6	1.8%	18.9	5.2	42.4%	(53.0)	(34.1)	(15.2)	22.5	41.4	60.2
C	133	309	6.4	2.1%	31.7	4.9	42.0%	(88.8)	(57.1)	(25.3)	38.2	69.9	101.6
D	133	337	7.9	2.3%	37.1	4.7	41.6%	(103.5)	(66.4)	(29.3)	45.0	82.1	119.2
E	133	339	8.3	2.4%	39.0	4.7	41.6%	(108.6)	(69.7)	(30.7)	47.2	86.2	125.2
F	76	174	4.8	2.8%	23.7	4.9	42.0%	(66.4)	(42.7)	(18.9)	28.6	52.3	76.0
A'	500	356	1.4	0.4%	17.5	12.4	46.8%	(51.2)	(33.6)	(16.1)	18.9	36.5	54.0
B'	500	404	2.8	0.7%	21.9	7.9	44.9%	(63.1)	(41.1)	(19.2)	24.7	46.7	68.6
C'	500	515	5.6	1.1%	33.7	6.0	43.4%	(95.4)	(61.7)	(28.1)	39.2	72.9	106.6
D'	500	544	7.0	1.3%	38.8	5.5	42.8%	(109.3)	(70.5)	(31.8)	45.8	84.6	123.3
E'	500	546	7.4	1.4%	40.5	5.5	42.7%	(114.2)	(73.7)	(33.1)	48.0	88.5	129.1
F'	500	413	4.2	1.0%	26.6	6.3	43.7%	(75.7)	(49.0)	(22.4)	30.8	57.4	84.1

	Number of Hands Back Counted					1,000		Expected Win + k*(Std Dev) = μ + k*σ, k ε {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	265	298	4.5	1.5%	19.0	4.2	40.7%	(52.6)	(33.6)	(14.5)	23.5	42.6	61.6
B	265	394	7.3	1.8%	26.7	3.7	39.3%	(72.8)	(46.1)	(19.4)	33.9	60.6	87.3
C	265	617	12.8	2.1%	44.9	3.5	38.7%	(121.8)	(76.9)	(32.0)	57.7	102.6	147.5
D	265	674	15.7	2.3%	52.5	3.3	38.2%	(141.8)	(89.3)	(36.8)	68.2	120.7	173.2
E	265	679	16.5	2.4%	55.1	3.3	38.2%	(148.8)	(93.7)	(38.6)	71.7	126.8	181.9
F	151	348	9.6	2.8%	33.6	3.5	38.7%	(91.1)	(57.5)	(23.9)	43.2	76.8	110.3
A'	1,000	712	2.8	0.4%	24.8	8.8	45.5%	(71.5)	(46.7)	(22.0)	27.6	52.4	77.2
B'	1,000	808	5.6	0.7%	31.0	5.6	42.9%	(87.5)	(56.5)	(25.5)	36.6	67.7	98.7
C'	1,000	1,031	11.2	1.1%	47.6	4.3	40.7%	(131.7)	(84.0)	(36.4)	58.8	106.4	154.0
D'	1,000	1,088	14.0	1.3%	54.8	3.9	39.9%	(150.5)	(95.6)	(40.8)	68.9	123.7	178.6
E'	1,000	1,092	14.9	1.4%	57.3	3.9	39.8%	(157.1)	(99.8)	(42.5)	72.2	129.6	186.9
F'	1,000	826	8.4	1.0%	37.6	4.5	41.2%	(104.5)	(66.9)	(29.3)	46.0	83.7	121.3

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet (Input Betting Schedule Here)											
Red 7 "tc"	tot adv	A	B	C	D	E	F	A'	B'	C'	D'	E'	F'
-1	-0.90%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
0	-0.40%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
1	0.09%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
2	0.66%	1	1	1	1	1	0	1	1	1	1	1	0.5
3	1.21%	1	1	2	2	1.8	1	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4 Sch D: bet(t) = (tc - 1), no max Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2) Sch F: bet(t) = (tc - 2), max = 4

	Number of Hands Back Counted					2,000		Expected Win + k*(Std Dev) = μ + k*σ, k є {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	530	597	9.0	1.5%	26.9	3.0	36.9%	(71.8)	(44.9)	(17.9)	35.9	62.9	89.8
B	530	788	14.5	1.8%	37.7	2.6	35.0%	(98.7)	(61.0)	(23.2)	52.2	90.0	127.7
C	530	1,234	25.7	2.1%	63.5	2.5	34.3%	(164.8)	(101.3)	(37.8)	89.2	152.6	216.1
D	530	1,349	31.4	2.3%	74.2	2.4	33.6%	(191.3)	(117.1)	(42.8)	105.7	179.9	254.1
E	530	1,357	33.1	2.4%	77.9	2.4	33.6%	(200.7)	(122.8)	(44.8)	111.0	189.0	266.9
F	302	696	19.3	2.8%	47.5	2.5	34.2%	(123.1)	(75.7)	(28.2)	66.7	114.2	161.7
A'	2,000	1,424	5.7	0.4%	35.1	6.2	43.6%	(99.5)	(64.4)	(29.4)	40.7	75.8	110.8
B'	2,000	1,616	11.2	0.7%	43.9	3.9	40.0%	(120.5)	(76.6)	(32.7)	55.1	99.0	142.8
C'	2,000	2,062	22.3	1.1%	67.3	3.0	37.0%	(179.6)	(112.3)	(45.0)	89.7	157.0	224.3
D'	2,000	2,177	28.1	1.3%	77.6	2.8	35.9%	(204.6)	(127.0)	(49.5)	105.6	183.2	260.7
E'	2,000	2,185	29.8	1.4%	81.1	2.7	35.7%	(213.5)	(132.4)	(51.3)	110.8	191.9	273.0
F'	2,000	1,652	16.8	1.0%	53.2	3.2	37.6%	(142.9)	(89.7)	(36.5)	70.0	123.3	176.5

	Number of Hands Back Counted					4,000		Expected Win + k*(Std Dev) = μ + k*σ, k є {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	1,060	1,194	18.0	1.5%	38.1	2.1	31.8%	(96.3)	(58.2)	(20.1)	56.1	94.2	132.3
B	1,060	1,576	29.0	1.8%	53.4	1.8	29.3%	(131.1)	(77.7)	(24.4)	82.4	135.7	189.1
C	1,060	2,468	51.4	2.1%	89.8	1.7	28.4%	(218.0)	(128.2)	(38.4)	141.1	230.9	320.7
D	1,060	2,698	62.8	2.3%	105.0	1.7	27.5%	(252.1)	(147.1)	(42.2)	167.8	272.8	377.8
E	1,060	2,715	66.2	2.4%	110.2	1.7	27.4%	(264.4)	(154.2)	(44.0)	176.4	286.6	396.8
F	604	1,392	38.5	2.8%	67.1	1.7	28.3%	(162.9)	(95.7)	(28.6)	105.7	172.8	239.9
A'	4,000	2,849	11.3	0.4%	49.6	4.4	41.0%	(137.4)	(87.8)	(38.2)	60.9	110.5	160.0
B'	4,000	3,232	22.3	0.7%	62.1	2.8	36.0%	(163.9)	(101.8)	(39.7)	84.4	146.5	208.6
C'	4,000	4,123	44.7	1.1%	95.2	2.1	31.9%	(241.0)	(145.8)	(50.5)	139.9	235.1	330.3
D'	4,000	4,353	56.2	1.3%	109.7	2.0	30.4%	(272.9)	(163.2)	(53.5)	165.8	275.5	385.2
E'	4,000	4,370	59.5	1.4%	114.7	1.9	30.2%	(284.5)	(169.9)	(55.2)	174.2	288.9	403.6
F'	4,000	3,304	33.6	1.0%	75.3	2.2	32.8%	(192.3)	(117.0)	(41.7)	108.9	184.1	259.4

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet (Input Betting Schedule Here)											
Red 7 "tc"	tot adv	A	B	C	D	E	F	A'	B'	C'	D'	E'	F'
-1	-0.90%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
0	-0.40%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
1	0.09%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
2	0.66%	1	1	1	1	1	0	1	1	1	1	1	0.5
3	1.21%	1	1	2	2	1.8	1	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4   Sch D: bet(t) = (tc - 1), no max   Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2)   Sch F: bet(t) = (tc - 2), max = 4

	Number of Hands Back Counted					8,000		Expected Win + k*(Std Dev) = μ + k*σ, k ϵ {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	2,120	2,387	36.0	1.5%	53.9	1.5	25.2%	(125.6)	(71.7)	(17.9)	89.9	143.8	197.6
B	2,120	3,153	58.0	1.8%	75.5	1.3	22.1%	(168.4)	(92.9)	(17.5)	133.5	208.9	284.4
C	2,120	4,936	102.7	2.1%	127.0	1.2	20.9%	(278.2)	(151.2)	(24.2)	229.7	356.6	483.6
D	2,120	5,396	125.7	2.3%	148.5	1.2	19.9%	(319.8)	(171.3)	(22.8)	274.1	422.6	571.1
E	2,120	5,429	132.4	2.4%	155.9	1.2	19.8%	(335.2)	(179.3)	(23.5)	288.2	444.1	600.0
F	1,208	2,783	77.1	2.8%	94.9	1.2	20.8%	(207.7)	(112.8)	(17.9)	172.0	266.9	361.9
A'	8,000	5,698	22.7	0.4%	70.1	3.1	37.3%	(187.7)	(117.5)	(47.4)	92.8	162.9	233.0
B'	8,000	6,463	44.7	0.7%	87.8	2.0	30.6%	(218.7)	(130.9)	(43.1)	132.4	220.2	308.0
C'	8,000	8,247	89.4	1.1%	134.7	1.5	25.3%	(314.6)	(180.0)	(45.3)	224.0	358.7	493.3
D'	8,000	8,706	112.3	1.3%	155.1	1.4	23.5%	(353.0)	(197.9)	(42.8)	267.4	422.5	577.6
E'	8,000	8,740	119.0	1.4%	162.2	1.4	23.2%	(367.5)	(205.4)	(43.2)	281.2	443.4	605.6
F'	8,000	6,607	67.1	1.0%	106.5	1.6	26.4%	(252.3)	(145.8)	(39.4)	173.6	280.1	386.6

	Number of Hands Back Counted					16,000		Expected Win + k*(Std Dev) = μ + k*σ, k ϵ {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	4,240	4,774	72.0	1.5%	76.2	1.1	17.2%	(156.5)	(80.3)	(4.2)	148.2	224.4	300.6
B	4,240	6,306	116.0	1.8%	106.7	0.9	13.8%	(204.1)	(97.4)	9.3	222.7	329.5	436.2
C	4,240	9,873	205.4	2.1%	179.6	0.9	12.6%	(333.2)	(153.7)	25.9	385.0	564.5	744.1
D	4,240	10,792	251.3	2.3%	210.0	0.8	11.6%	(378.6)	(168.6)	41.4	461.3	671.3	881.3
E	4,240	10,858	264.7	2.4%	220.4	0.8	11.5%	(396.5)	(176.1)	44.3	485.2	705.6	926.0
F	2,416	5,567	154.2	2.8%	134.3	0.9	12.5%	(248.6)	(114.4)	19.9	288.4	422.7	556.9
A'	16,000	11,395	45.3	0.4%	99.1	2.2	32.4%	(252.1)	(153.0)	(53.8)	144.5	243.6	342.7
B'	16,000	12,926	89.3	0.7%	124.2	1.4	23.6%	(283.2)	(159.0)	(34.8)	213.5	337.6	461.8
C'	16,000	16,494	178.7	1.1%	190.4	1.1	17.4%	(392.6)	(202.1)	(11.7)	369.2	559.6	750.0
D'	16,000	17,412	224.6	1.3%	219.3	1.0	15.3%	(433.4)	(214.1)	5.3	444.0	663.3	882.7
E'	16,000	17,479	238.0	1.4%	229.4	1.0	15.0%	(450.1)	(220.7)	8.7	467.4	696.8	926.1
F'	16,000	13,215	134.2	1.0%	150.6	1.1	18.6%	(317.5)	(166.9)	(16.3)	284.8	435.4	586.0

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet (Input Betting Schedule Here)											
Red 7 "tc"	tot adv	A	B	C	D	E	F	A'	B'	C'	D'	E'	F'
-1	-0.90%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
0	-0.40%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
1	0.09%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
2	0.66%	1	1	1	1	1	0	1	1	1	1	1	0.5
3	1.21%	1	1	2	2	1.8	1	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4   Sch D: bet(t) = (tc - 1), no max   Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2)   Sch F: bet(t) = (tc - 2), max = 4

	Number of Hands Back Counted				32,000			Expected Win + k*(Std Dev) = μ + k*σ, k ϵ {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	8,480	9,548	144.0	1.5%	107.7	0.7	9.1%	(179.2)	(71.4)	36.3	251.8	359.5	467.3
B	8,480	12,611	232.0	1.8%	150.9	0.7	6.2%	(220.7)	(69.8)	81.1	383.0	533.9	684.8
C	8,480	19,746	410.9	2.1%	253.9	0.6	5.3%	(350.9)	(97.0)	156.9	664.8	918.7	1,172.7
D	8,480	21,583	502.7	2.3%	296.9	0.6	4.5%	(388.2)	(91.2)	205.7	799.6	1,096.6	1,393.5
E	8,480	21,716	529.5	2.4%	311.7	0.6	4.5%	(405.7)	(94.0)	217.8	841.2	1,152.9	1,464.6
F	4,832	11,134	308.3	2.8%	189.9	0.6	5.2%	(261.3)	(71.4)	118.4	498.2	688.1	877.9
A'	32,000	22,790	90.6	0.4%	140.2	1.5	25.9%	(330.0)	(189.8)	(49.6)	230.8	371.0	511.2
B'	32,000	25,853	178.6	0.7%	175.6	1.0	15.5%	(348.1)	(172.5)	3.0	354.2	529.8	705.3
C'	32,000	32,987	357.4	1.1%	269.3	0.8	9.2%	(450.5)	(181.2)	88.1	626.8	896.1	1,165.4
D'	32,000	34,825	449.2	1.3%	310.2	0.7	7.4%	(481.4)	(171.2)	139.0	759.4	1,069.6	1,379.8
E'	32,000	34,958	476.1	1.4%	324.4	0.7	7.1%	(497.1)	(172.7)	151.7	800.4	1,124.8	1,449.2
F'	32,000	26,429	268.5	1.0%	213.0	0.8	10.4%	(370.4)	(157.4)	55.5	481.4	694.4	907.3

	Number of Hands Back Counted				48,000			Expected Win + k*(Std Dev) = μ + k*σ, k ϵ {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	12,720	14,323	216.1	1.5%	132.0	0.6	5.1%	(179.8)	(47.8)	84.1	348.0	480.0	611.9
B	12,720	18,917	348.1	1.8%	184.8	0.5	3.0%	(206.5)	(21.6)	163.2	532.9	717.7	902.6
C	12,720	29,618	616.3	2.1%	311.0	0.5	2.4%	(316.7)	(5.7)	305.3	927.3	1,238.3	1,549.3
D	12,720	32,375	754.0	2.3%	363.7	0.5	1.9%	(337.1)	26.6	390.3	1,117.7	1,481.4	1,845.0
E	12,720	32,575	794.2	2.4%	381.8	0.5	1.9%	(351.1)	30.7	412.5	1,176.0	1,557.8	1,939.6
F	7,248	16,701	462.5	2.8%	232.5	0.5	2.3%	(235.2)	(2.6)	229.9	695.0	927.5	1,160.1
A'	48,000	34,185	135.9	0.4%	171.7	1.3	21.4%	(379.2)	(207.5)	(35.8)	307.7	479.4	651.1
B'	48,000	38,779	267.9	0.7%	215.0	0.8	10.6%	(377.2)	(162.2)	52.9	483.0	698.0	913.0
C'	48,000	49,481	536.2	1.1%	329.8	0.6	5.2%	(453.4)	(123.5)	206.3	866.0	1,195.8	1,525.7
D'	48,000	52,237	673.8	1.3%	379.9	0.6	3.8%	(465.9)	(86.0)	293.9	1,053.8	1,433.7	1,813.6
E'	48,000	52,437	714.1	1.4%	397.3	0.6	3.6%	(477.7)	(80.5)	316.8	1,111.4	1,508.6	1,905.9
F'	48,000	39,644	402.7	1.0%	260.8	0.6	6.1%	(379.7)	(118.9)	141.9	663.5	924.4	1,185.2

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

		Betting Schedule, Units Bet (Input Betting Schedule Here)											
Red 7 "tc"	tot adv	A	B	C	D	E	F	A'	B'	C'	D'	E'	F'
-1	-0.90%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
0	-0.40%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
1	0.09%	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5
2	0.66%	1	1	1	1	1	0	1	1	1	1	1	0.5
3	1.21%	1	1	2	2	1.8	1	1	1	2	2	1.8	1
4	1.90%	1	2	3	3	2.9	2	1	2	3	3	2.9	2
5	2.71%	1	2	4	4	4.1	3	1	2	4	4	4.1	3
6	3.59%	1	2	4	5	5.4	4	1	2	4	5	5.4	4
7	4.46%	1	2	4	6	6.7	4	1	2	4	6	6.7	4
8	5.34%	1	2	4	7	8.1	4	1	2	4	7	8.1	4
9	6.21%	1	2	4	8	9.4	4	1	2	4	8	9.4	4
10	7.09%	1	2	4	9	10.7	4	1	2	4	9	10.7	4

Sch C: bet(t) = (tc - 1), max = 4   Sch D: bet(t) = (tc - 1), no max   Sch E: bet(2) = 1, tc >=3: bet(t) = adv(t) / adv(2)   Sch F: bet(t) = (tc - 2), max = 4

	Number of Hands Back Counted				64,000		Expected Win + k*(Std Dev) = μ + k*σ, k ϵ {-3,-2,-1,1,2,3}					
Betting Sch	# hands played	Amt Bet	μ = Exp. Win	% adv = E(win) / Bet	σ = Std Dev	(σ/μ)	P(Win <= 0)	-3	-2	-1	1	2	3
A	16,960	19,097	288.1	1.5%	152.4	0.5	2.9%	(169.0)	(16.6)	135.7	440.5	592.8	745.2
B	16,960	25,222	464.1	1.8%	213.4	0.5	1.5%	(176.2)	37.2	250.6	677.5	891.0	1,104.4
C	16,960	39,491	821.7	2.1%	359.1	0.4	1.1%	(255.6)	103.5	462.6	1,180.9	1,540.0	1,899.1
D	16,960	43,166	1,005.3	2.3%	420.0	0.4	0.8%	(254.5)	165.4	585.4	1,425.3	1,845.2	2,265.2
E	16,960	43,433	1,059.0	2.4%	440.8	0.4	0.8%	(263.5)	177.3	618.1	1,499.8	1,940.7	2,381.5
F	9,664	22,268	616.6	2.8%	268.5	0.4	1.1%	(188.9)	79.6	348.1	885.1	1,153.7	1,422.2
A'	64,000	45,580	181.2	0.4%	198.3	1.1	18.0%	(413.6)	(215.3)	(17.0)	379.5	577.8	776.1
B'	64,000	51,706	357.2	0.7%	248.3	0.7	7.5%	(387.7)	(139.4)	108.9	605.5	853.8	1,102.1
C'	64,000	65,975	714.9	1.1%	380.9	0.5	3.0%	(427.7)	(46.8)	334.0	1,095.8	1,476.6	1,857.5
D'	64,000	69,650	898.5	1.3%	438.7	0.5	2.0%	(417.6)	21.1	459.8	1,337.2	1,775.9	2,214.5
E'	64,000	69,916	952.1	1.4%	458.7	0.5	1.9%	(424.1)	34.7	493.4	1,410.9	1,869.6	2,328.3
F'	64,000	52,859	537.0	1.0%	301.2	0.6	3.7%	(366.5)	(65.4)	235.8	838.1	1,139.3	1,440.4

Want: μ, % adv and μ - 2*σ as large as possible and σ, (σ/μ) and P(Loss) = P(Win <= 0) as small as possible.

(1) Betting Schedule C has the optimal combination of μ, % adv and μ - 2*σ (as large as possible) and σ, (σ/μ) and P(Win <=0) (as small as possible).

(2) P(Win <= μ - 2*σ) ≈ 2.3%. If 2.3% is thought of as the maximum probable loss and if (μ - 2*σ) < 0, then the absolute value of column (μ - 2*σ) gives the maximum probable loss (MPL). If (μ - 2*σ) > 0, then chance of loss is negligible, i.e. P(Win <= 0) < P(Win <= (μ - 2*σ)) = 2.3%. The MPL is measured at the *end* of the given number of hands played, i.e. the chance of losing the MPL or more at the end of playing the given number or hands is 2.3%. During the play of the given number of hands, the loss may exceed the MPL. The risk of ruin bankroll takes this into account as explained later in this paper.

Notes:

(1) % adv of betting Schedule C is 2.1% which is only 0.2% or so below the % adv of Schedules D and E. Betting Schedules D and E would label you as a counter to casino personnel quicker than betting Schedule C.

(2) P(Loss) = P(Win <= 0) = NORMDIST(0,μ,σ,TRUE) = Probability that player is behind categorized by hands back counted and betting schedule. The probability of loss, similar to MPL, is measured at the end of the given number of hands played, i.e. the bankroll is checked for a loss at the end of playing the given number of hands, not during the play of those hands.

(3) Every time number of hands played is quadrupled, (σ/μ) is cut in half.

(4) Betting Schedules A' through F' shows drop off in μ and % adv and increase in σ, (σ/μ) and P(Win <= 0) when playing some hands at Red 7 tc < 2.

(5) Betting Schedule C, 64,000 back counted hands, 16,960 hands played, W = amount won:

μ =	821.7	σ =	359.1	P(W <= 103.5) = P(W <= μ - 2*σ) = NORMDIST(-2,0,1,TRUE	2.3%
(σ/μ) =	0.44	μ - 2*σ =	103.5	P(W <= 103.5) = NORMDIST(103.5,μ,σ,TRUE) =	2.3%

(6) μ < σ: MPL increases. μ = σ: maximum MPL is reached. σ < μ < 2*σ: MPL decreases. μ = 2*σ: MPL = 0, μ > 2*σ MPL = 0.

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

k = factor for doubles and splits
10% doubles, 2% splits, 0.6% DAS
k = 1.126 AACpTCp = 0.495% Idx = 0.81
"k" is applied in Col (G3)

Exhibit F1a
Betting, S17, DAS, no LS

u = units bet, freq(u) = frequency of "u" bets and W = amount won:
SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])
where SD(X) = Standard Deviation of a single BJ hand = 1.17

Number of Hands back counted 500

(A) Red 7 "tc"	(B) Hand %	(C) Hand Frequency	(D) ba(t)	(E) sg(t)	(F) = (D) + (E) tpa(t)	Betting Schedule A (G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2
-1	20.8%	104	-0.90%	0.00%	-0.90%	0	-	-	-	-
0	32.0%	160	-0.40%	0.00%	-0.40%	0	-	-	-	-
1	20.7%	104	0.09%	0.00%	0.09%	0	-	-	-	-
2	11.4%	57	0.59%	0.07%	0.66%	1	57	64	0.43	57
3	6.6%	33	1.08%	0.13%	1.21%	1	33	37	0.45	33
4	3.8%	19	1.58%	0.32%	1.90%	1	19	21	0.41	19
5	2.1%	11	2.07%	0.64%	2.71%	1	11	12	0.32	11
6	1.2%	6	2.57%	1.02%	3.59%	1	6	7	0.24	6
7	0.7%	4	3.06%	1.40%	4.46%	1	4	4	0.18	4
8	0.4%	2	3.56%	1.78%	5.34%	1	2	2	0.12	2
9	0.2%	1	4.05%	2.16%	6.21%	1	1	1	0.07	1
10	0.1%	1	4.55%	2.54%	7.09%	1	1	1	0.04	1
Total	100.0%	500				n/a	133	149	**2.3**	133

ba(t) = betting advantage: ba(t) = AACpTCp * (t - Idx) column (B): Exhibit F1d
sg(t) = strategy gain: sg(t) for t (Red 7 true counts) >= 7: sg(t) = sg(t-1) + {sg(t-1) - sg(t-2)}
tpa(t) = total player advantage columns (D) & (E): Exhibit F1a

Players Advantage = 2.25 / 149 = **1.51%** SQRT:
Standard Deviation = SQRT(Tot (G5)) * 1.17 **13** 12
Standard Deviation / Expected Win **6.0**

(A) Red 7 "tc"	Betting Schedule B (G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2	Betting Schedule C (G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2
-1	0	-	-	-	-	0	-	-	-	-
0	0	-	-	-	-	0	-	-	-	-
1	0	-	-	-	-	0	-	-	-	-
2	1	57	64	0.43	57	1	57	64	0.43	57
3	1	33	37	0.45	33	2	33	74	0.90	132
4	2	19	43	0.81	76	3	19	64	1.22	171
5	2	11	24	0.64	42	4	11	47	1.28	168
6	2	6	14	0.48	24	4	6	27	0.97	96
7	2	4	8	0.35	14	4	4	16	0.70	56
8	2	2	5	0.24	8	4	2	9	0.48	32
9	2	1	2	0.14	4	4	1	5	0.28	16
10	2	1	1	0.08	2	4	1	2	0.16	8
Total	n/a	133	197	**3.6**	260	n/a	133	309	**6.4**	736

Schedule B:
Players Advantage = 3.63 / 197 = **1.84%** SQRT:
Standard Deviation = SQRT(Tot (G5)) * 1.17 **19** 16
Standard Deviation / Expected Win **5.2**

Schedule C:
Players Advantage = 6.42 / 309 = **2.08%** SQRT:
Standard Deviation = SQRT(Tot (G5)) * 1.17 **32** 27
Standard Deviation / Expected Win **4.9**

Exhibit F1c

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

k = factor for doubles and splits
10% doubles, 2% splits, 0.6% DAS
k = 1.126 AACpTCp = 0.495% Idx = 0.81

Exhibit F1a
Betting, S17, DAS, no LS

u = units bet, freq(u) = frequency of "u" bets and W = amount won:
SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])
where SD(X) = Standard Deviation of a single BJ hand = 1.17

	Betting Schedule D					Betting Schedule E				
(A) Red 7 "tc"	(G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2	(G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2
-1	0	-	-	-	-	0	-	-	-	-
0	0	-	-	-	-	0	-	-	-	-
1	0	-	-	-	-	0	-	-	-	-
2	1	57	64	0.43	57	1	57	64	0.43	57
3	2	33	74	0.90	132	1.8	33	67	0.81	107
4	3	19	64	1.22	171	2.9	19	62	1.18	160
5	4	11	47	1.28	168	4.1	11	48	1.31	177
6	5	6	34	1.21	150	5.4	6	36	1.31	175
7	6	4	24	1.06	126	6.7	4	26	1.18	157
8	7	2	16	0.84	98	8.1	2	18	0.97	131
9	8	1	9	0.56	64	9.4	1	11	0.66	88
10	9	1	5	0.36	41	10.7	1	6	0.43	57
Total	n/a	133	337	**7.9**	1,007	n/a	133	339	**8.3**	1,109
	Players Advantage = 7.85 / 337 =			**2.33%**	SQRT:	Players Advantage = 8.27 / 339 =			**2.44%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**37**	32	Standard Deviation = SQRT(Tot (G5)) * 1.17			**39**	33
	Standard Deviation / Expected Win			**4.7**		Standard Deviation / Expected Win			**4.7**	

	Betting Schedule F					Betting Schedule A'				
(A) Red 7 "tc"	(G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2	(G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2
-1	0	-	-	-	-	0.5	104	59	(0.53)	26
0	0	-	-	-	-	0.5	160	90	(0.36)	40
1	0	-	-	-	-	0.5	104	58	0.05	26
2	0	-	-	-	-	1	57	64	0.43	57
3	1	33	37	0.45	33	1	33	37	0.45	33
4	2	19	43	0.81	76	1	19	21	0.41	19
5	3	11	35	0.96	95	1	11	12	0.32	11
6	4	6	27	0.97	96	1	6	7	0.24	6
7	4	4	16	0.70	56	1	4	4	0.18	4
8	4	2	9	0.48	32	1	2	2	0.12	2
9	4	1	5	0.28	16	1	1	1	0.07	1
10	4	1	2	0.16	8	1	1	1	0.04	1
Total	n/a	76	174	**4.8**	412	n/a	500	356	**1.4**	224
	Players Advantage = 4.82 / 174 =			**2.77%**	SQRT:	Players Advantage = 1.42 / 356 =			**0.40%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**24**	20	Standard Deviation = SQRT(Tot (G5)) * 1.17			**18**	15
	Standard Deviation / Expected Win			**4.9**		Standard Deviation / Expected Win			**12.4**	

Exhibit F1c

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

k = factor for doubles and splits
10% doubles, 2% splits, 0.6% DAS
k = 1.126 AACpTCp = 0.495% Idx = 0.81

Exhibit F1a
Betting, S17, DAS, no LS

u = units bet, freq(u) = frequency of "u" bets and W = amount won:
SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])
where SD(X) = Standard Deviation of a single BJ hand = 1.17

	Betting Schedule B'					Betting Schedule C'				
(A)	(G1)	(G2)	(G3)=(G1)*(G2)*k	(G4) = (G3) * (F)	(G5)	(G1)	(G2)	(G3)=(G1)*(G2)*k	(G4) = (G3) * (F)	(G5)
Red 7 "tc"	Units Bet	# hands played	Amount Bet	Expected Win	= (G2)*(G1)^2	Units Bet	# hands played	Amount Bet	Expected Win	= (G2)*(G1)^2
-1	0.5	104	59	(0.53)	26	0.5	104	59	(0.53)	26
0	0.5	160	90	(0.36)	40	0.5	160	90	(0.36)	40
1	0.5	104	58	0.05	26	0.5	104	58	0.05	26
2	1	57	64	0.43	57	1	57	64	0.43	57
3	1	33	37	0.45	33	2	33	74	0.90	132
4	2	19	43	0.81	76	3	19	64	1.22	171
5	2	11	24	0.64	42	4	11	47	1.28	168
6	2	6	14	0.48	24	4	6	27	0.97	96
7	2	4	8	0.35	14	4	4	16	0.70	56
8	2	2	5	0.24	8	4	2	9	0.48	32
9	2	1	2	0.14	4	4	1	5	0.28	16
10	2	1	1	0.08	2	4	1	2	0.16	8
Total	n/a	500	404	**2.8**	352	n/a	500	515	**5.6**	828
	Players Advantage = 2.79 / 404 =			**0.69%**	SQRT:	Players Advantage = 5.59 / 515 =			**1.08%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**22**	19	Standard Deviation = SQRT(Tot (G5)) * 1.17			**34**	29
	Standard Deviation / Expected Win			**7.9**		Standard Deviation / Expected Win			**6.0**	

	Betting Schedule D'					Betting Schedule E'				
(A)	(G1)	(G2)	(G3)=(G1)*(G2)*k	(G4) = (G3) * (F)	(G5)	(G1)	(G2)	(G3)=(G1)*(G2)*k	(G4) = (G3) * (F)	(G5)
Red 7 "tc"	Units Bet	# hands played	Amount Bet	Expected Win	= (G2)*(G1)^2	Units Bet	# hands played	Amount Bet	Expected Win	= (G2)*(G1)^2
-1	0.5	104	59	(0.53)	26	0.5	104	59	(0.53)	26
0	0.5	160	90	(0.36)	40	0.5	160	90	(0.36)	40
1	0.5	104	58	0.05	26	0.5	104	58	0.05	26
2	1	57	64	0.43	57	1	57	64	0.43	57
3	2	33	74	0.90	132	1.8	33	67	0.81	107
4	3	19	64	1.22	171	2.9	19	62	1.18	160
5	4	11	47	1.28	168	4.1	11	48	1.31	177
6	5	6	34	1.21	150	5.4	6	36	1.31	175
7	6	4	24	1.06	126	6.7	4	26	1.18	157
8	7	2	16	0.84	98	8.1	2	18	0.97	131
9	8	1	9	0.56	64	9.4	1	11	0.66	88
10	9	1	5	0.36	41	10.7	1	6	0.43	57
Total	n/a	500	544	**7.0**	1,098	n/a	500	546	**7.4**	1,201
	Players Advantage = 7.02 / 544 =			**1.29%**	SQRT:	Players Advantage = 7.44 / 546 =			**1.36%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**39**	33	Standard Deviation = SQRT(Tot (G5)) * 1.17			**41**	35
	Standard Deviation / Expected Win			**5.5**		Standard Deviation / Expected Win			**5.5**	

Exhibit F1c

Analysis of Various Betting Schedules
Expected Win, Standard Deviation and Player's Advantage
Six Decks, 4.5 Decks Dealt
Red 7 True Count >= -1
Leave Table if Red 7 true count < -1

k = factor for doubles and splits
10% doubles, 2% splits, 0.6% DAS
k = 1.126 AACpTCp = 0.495% Idx = 0.81

Exhibit F1a
Betting, S17, DAS, no LS

u = units bet, freq(u) = frequency of "u" bets and W = amount won:
SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])
where SD(X) = Standard Deviation of a single BJ hand = 1.17

	Betting Schedule F'				
(A) Red 7 "tc"	(G1) Units Bet	(G2) # hands played	(G3)=(G1)*(G2)*k Amount Bet	(G4) = (G3) * (F) Expected Win	(G5) = (G2)*(G1)^2
-1	0.5	104	59	(0.53)	26
0	0.5	160	90	(0.36)	40
1	0.5	104	58	0.05	26
2	0.5	57	32	0.21	14
3	1	33	37	0.45	33
4	2	19	43	0.81	76
5	3	11	35	0.96	95
6	4	6	27	0.97	96
7	4	4	16	0.70	56
8	4	2	9	0.48	32
9	4	1	5	0.28	16
10	4	1	2	0.16	8
Total	n/a	500	413	**4.2**	518
	Players Advantage = 4.2 / 413 =			**1.02%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**27**	23
	Standard Deviation / Expected Win			**6.3**	

Calculation of the Standard Deviation of a Single Blackjack Hand

Approximate Blackjack Distribution with Pushes, Blackjacks, Doubles and Splits with DAS (Double After Split) allowed.
X = amount won from an initial one unit bet.
(See next Exhibits for reconciliation of % adv & expected win and for explanation of how f(x) was approximated)

x	f(x)	x*f(x)	x- μ	(x- μ)^2	(x- μ)^2 * f(x)
4.00	0.0002	0.0008	4.0095	16.0761	0.0032
3.00	0.0026	0.0078	3.0095	9.0571	0.0235
2.00	0.0572	0.1144	2.0095	4.0381	0.2310
1.50	0.0450	0.0675	1.5095	2.2786	0.1025
1.00	0.3440	0.3440	1.0095	1.0191	0.3506
0.00	0.0700	0.0000	0.0095	0.0001	0.0000
-1.00	0.4210	-0.4210	-0.9905	0.9811	0.4130
-2.00	0.0572	-0.1144	-1.9905	3.9621	0.2266
-3.00	0.0026	-0.0078	-2.9905	8.9431	0.0233
-4.00	0.0002	-0.0008	-3.9905	15.9241	0.0032
Total	1.0000	***-0.0095***	n/a	n/a	***σ^2 = variance 1.38***
E(X) = Expected Amount Won = μ ≈ -0.0095		**μ**		***σ = standard deviation***	***1.17***

X = amount won from a one unit bet:
Std Dev from a one unit blackjack bet SD(X)
Std Dev from "n" bets of one unit each (i) SQRT(n)*SD(X)

Z = amount won from a "u" unit bet:
Z = u*X
(If all of the values in column "x" are doubled (2 units bet),
variance is quadrupled & std dev is doubled)
Then Var (Z) = Var (u*X) = u^2 * Var(X)
SD(Z) = SQRT(Var(Z)) = u*SD(X)
Std Dev from a "u" unit blackjack bet u*SD(X)
Std Dev from "n" bets of "u" unit each (ii) SQRT(n)*(u*SD(X))

W = amount won from "n1" one unit bets and "n2" u unit bets
W = X1 + X2 + … + Xn1 + Z1 + Z2 + … + Zn2
Var(W) = Var(X1) + Var(X2) + .. + Var(Xn1) + …
...+ Var(Z1) + Var(Z2) + … + Var(Zn2)
Var(W) = n1*(Var(X)) + n2*(Var(Z)) = n1*Var(X) + n2*(Var(u*X))
= n1*Var(X) + n2*(u^2)*Var(X) = Var(X)* (n1 + n2*(u^2))
SD(W) = SD(X) * SQRT(n1 + n2*(u^2))
note: if n2 = 0, result is (i) above and if n1 = 0 result is (ii) above.

Standard deviation from "n" blackjack hands of one unit each:
Let Y = X1 + X2 + … + Xn
assume: Xi are i.i.d. (independently and identically distributed)
Var (a1*X1 +a2*X2)
= ((a1)^2)*(Var(X1)) + ((a2)^2)*(Var(X2))
Here a1 = a2 = … 1 and Var(X1) = Var(X2) =.. Var (X)
Var (Y) = Var (X1 + X2 +… + Xn) = n * Var(X)
SD(Y) = SQRT(Var(Y)) = SQRT(n) * SD(X)
mean(X) = Y/n
Var(Mean(X)) = Var(Y/n) = ((1/n)^2) * Var(Y) = ((1/n)^2)*(n*Var(X)) = Var(X) / n
SD(Mean(X)) = SQRT(Var(Mean(X)) = SQRT(Var(X) / n) = SD(X) / SQRT(n)

E(Y) = E(Sum(X)) = n * E(X) where n = # of X's
SD(Y) = SD(Sum(X)) = SQRT(n) * SD(X) where n = # of X's
So (σ/μ) = SD(Y) / E(Y) = (SQRT(n) / n) * (SD(X) / E(X))
= (1.0 / SQRT(n)) * (SD(X) / E(X)) for "n" one unit bets
If "n" is quadrupled, (σ/μ) is cut in half.

u = units bet, freq(u) = frequency of "u" bets and W = amount won:
SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])
where SD(X) = Standard Deviation of a single BJ hand = 1.17

If NDAS, then f(+/-3) = f(+/-4) = 0 and f(+/-2) = 0.0600. All other values of f(x) remain unchanged.
The new distribution has a mean of -0.0095 (unchanged) and a standard deviation of 1.16 (as compared to 1.17 for DAS).

Reconciliation of
Expected Amount Won and Percent Advantage
of a Single Blackjack Hand

W = amount won from an initial one unit bet
B = amount bet, initial bet of one unit

% advantage = Amount Won / Amount Bet
% advantage = E(W) / E(B)

w	f(w)	w*f(w)	b	f(b)	b*f(b)
4.00	0.0002	0.0008	4	0.0002	0.0008
3.00	0.0026	0.0078	3	0.0026	0.0078
2.00	0.0572	0.1144	2	0.0572	0.1144
1.50	0.0450	0.0675	1	0.0450	0.0450
1.00	0.3440	0.3440	1	0.3440	0.3440
0.00	0.0700	0.0000	1	0.0700	0.0700
-1.00	0.4210	-0.4210	1	0.4210	0.4210
-2.00	0.0572	-0.1144	2	0.0572	0.1144
-3.00	0.0026	-0.0078	3	0.0026	0.0078
-4.00	0.0002	-0.0008	4	0.0002	0.0008
Total	1.0000	***-0.0095***		1.0000	***1.126***

Expected Win = E(W) = -0.0095

Expected Bet = E(B) = 1.126

% advantage = -0.0095 / 1.126 = -0.84%

% advantage of -0.84% is in good agreement with full six deck advantage of around -0.60%.
Differences are due to approximations used in estimating f(w) = PDF of the amount won.
PDF = probability density function.

Note: A initial one unit bet will result in an average final bet of 1.126 units. The f(b) PDF shown above assumes DAS. If NDAS then, given 10% of hands are doubled and 2% are split, each of which required an additional unit bet, the average final bet would be 12% larger than the initial bet giving a final bet of 1.12 units for a initial bet of one unit. The extra 0.006 units above is from the DAS option.

Estimation of Probability Density Function (PDF), f(x), for a Single Blackjack Hand
X = amount won from a one unit bet and f(x) = P(X=x)

x	f(x)	x*f(x)
4.00	0.0002	0.0008
3.00	0.0026	0.0078
2.00	0.0572	0.1144
1.50	0.0450	0.0675
1.00	0.3440	0.3440
0.00	0.0700	0.0000
-1.00	0.4210	-0.4210
-2.00	0.0572	-0.1144
-3.00	0.0026	-0.0078
-4.00	0.0002	-0.0008
Total	1.0000	***-0.0095***

Blackjack Forum Sept 1989
5% BJ
10% doubles
2% splits
16% basic strategy player breaks
28% dealer breaks

P(1.5 units won)
pBJ = player BJ, dBJ = dealer BJ
Six Decks: 24 A (aces) and 96 T (tens)
P(1.5 units won) = P(uncontested BJ) =
P(pBJ) - P(pBJ and dBJ) =
P(pBJ) = P(A)*P(T given A) + P(T)*P(A given T) = 2*(24/312)*(96/311)
P(pBJ and dBJ) = 2*(24/312)*(96/311)*2*(23/310)*(95/309)
P(1.5 units won) = 2*(24/312)*(96/311) * (1.0 - 2*(23/310)*(95/309)) =
4.53%
Use 4.5% for BJ instead of rounded 5% from BJF Sept 1989

Definitions

pS = Player Stiff	pS + pP + pB = 1.0
pP = Player Pat hand	pB = 16%
pB = Player Breaks	pS ≈ 35% (see below)
	Therefore, pP = 49%
dB = Dealer Breaks	dP + dB = 1.0
dP = Dealer Pat hand	dB = 28%
P = Push	Therefore, dP = 72%

Estimation of Probability Density Function (PDF), f(x), for a Single Blackjack Hand
X = amount won from a one unit bet and f(x) = P(X=x)

Estimation of pS = basic strategy percentage of Player Stiffs

Basic Strategy: s = stand, h = hit

Player's Hand	Dealer's Up Card 2	3	4	5	6	7	8	9	T	A
12	h	h	s	s	s	h	h	h	h	h
13	s	s	s	s	s	h	h	h	h	h
14	s	s	s	s	s	h	h	h	h	h
15	s	s	s	s	s	h	h	h	h	h
16	s	s	s	s	s	h	h	h	h	h
% dealer bust *	35%	38%	40%	43%	42%	26%	24%	23%	21%	11%

* from Theory of Blackjack, 6th edition, page 18.

Note: Weighted Average of all Dealer Busts = (35% + 38% + 40% + 43% + 42% + 26% + 24% + 23% + 4*(21%) + 11%) / 13 = 28% = overall "dB" above.

Possible Stiffs occurs with players hands of 12 through 16. There are a total of 13 possibilities (different dealer up card's) for each player's hand of 12, 13, 14, 15 and 16 for a total of 5*13 = 65 possible different stiffs. Basic Strategy stands on 23 of these 65 possible difference stiffs.
So pS ≈ 23/65 ≈ 35%

Average Probability of Dealer Break and Dealer Pat when Player has a Stiff:

Let dB' = average probability of dealer Break when player has stiff
Let dP' = average probability of dealer Pat hand when player has stiff
dB' = (4*35% + 4*38% + 5*40% + 5*43% + 5*42%) / 23 = 39.9%
dP' = 1.0 - dB' = 60.1%

Note:

By the definitions above:
dB' = dealer Breaks given player has a basic strategy stiff hand = (dB given pS)
dP' = dealer has Pat hand (does not break) given player has a basic strategy stiff hand = (dP given pS)
Prob(player has stiff and wins) = Prob(pS and dB) = Prob(pS)*Prob(dB given pS) = (pS)*(dB')
Prob(player has stiff and loses) = Prob(pS and dP) = Prob(pS)*Prob(dP given pS) = (pS)*(dP')

Estimation of Probability Density Function (PDF), f(x), for a Single Blackjack Hand
X = amount won from a one unit bet and f(x) = P(X=x)

Estimation of % pushes when Player's hand is Pat and Dealer's hand is Pat					
Player's Hand	Dealer's Hand 17	18	19	20	21
17	P	dW	dW	dW	dW
18	pW	P	dW	dW	dW
19	pW	pW	P	dW	dW
20	pW	pW	pW	P	dW
21	pW	pW	pW	pW	P

Player's Hand and Dealer's Hand both Pat
Definitions
pW = player wins
dW = dealer wins
P = Push
pW = 10/25 = 40%
dW = 10/25 = 40%
P = 5/25 = 20%

Calculation of f(0) = P(X=0) = prob push
f(0) = (pP)*(dP)*P
f(0) = (49%)*(72%)*(20%) = 7.0%

Estimation of Probability Density Function (PDF), f(x), for a Single Blackjack Hand
X = amount won from a one unit bet and f(x) = P(X=x)

Win of Lose 2, 3 or 4 units (DAS available)

10% doubles f(x) = probability of winning "x" units

2% splits Assume f(2) = f(-2), f(3) = f(-3), f(4) = f(-4)

10% doubles: win of lose 2 units 2% splits: win or lose 2, 3 or 4 units

Estimation of % +/-2, +/-3 and +/-4 from the 2% of hands split

Basic Strategy: s = stand, h = hit, d = double

Player's Hand	Dealer's Up Card									
	2	3	4	5	6	7	8	9	T	A
9	h	d	d	d	d	h	h	h	h	h
10	d	d	d	d	d	d	d	d	h	h
11	d	d	d	d	d	d	d	d	d	h

Possible Double after Split occurs when a one card hit on the split gives a total of 9, 10 or 11.
There are thirteen possible cards to hit each split hand.
One of these thirteen cards will produce a total of 9 on the split pair which basic strategy doubles 4 out of 13 times.
Another of these thirteen cards will produce a total of 10 which basic strategy doubles 8 out of the 13 times that it is produced
Finally one of these thirteen cards will produce a total of 11 which basic strategy doubles 12 out of the 13 times that it is produced.

So with DAS (Double after Split) available, for each split hand, the approximate percentage of basic strategy doubles is:

(1/13)*(4/13) + (1/13)*(8/13) + (1/13)*(12/13) ≈ 15%

% of DAS where neither split hand is doubled:

(85%)*(85%) ≈ 72%

% of DAS where both split hands are doubled:

(15%)*(15%) ≈ 2%

% of DAS of exactly one of the two split hands is:

prob(double 1st split and do not double 2nd split hand) + prob(do not double 1st split hand and double 2nd split hand)

(15%)*(85%) + (85%)*(15%) ≈ 26%

Note: (% of DAS = 0) + (% of DAS = 1) + (% of DAS = 2) = 72% + 26% + 2% = 100%

Estimation of Probability Density Function (PDF), f(x), for a Single Blackjack Hand
X = amount won from a one unit bet and f(x) = P(X=x)

<u>So here are the approximate values of f(x) where f(x) = P(X=x) and X = amount won from a single blackjack hand</u>

f(+/- 2) = prob(double) + prob(split and no double after split) = 10% + (2%)*(72%) ≈ 11.44% — f(2) = f(-2) = 0.50*11.44% = 5.72%

f(+/- 3) = prob(split and exactly one of the two splits are doubled) = (2%)*(26%) ≈ 0.52% — f(3) = f(-3) = 0.50*0.52% = 0.26%

f(+/- 4) = prob(split and both splits are doubled) = (2%)*(2%) ≈ 0.04% — f(4) = f(-4) = 0.50*0.04% = 0.02%

Note: f(+/- 2) + f(+/- 3) + f(+/- 4) = 12% = (% of doubles (10%) + % of splits (2%))

<u>Estimation of f(1) and f(-1)</u>

<u>Sum(f(x)) = 1</u>	<u>Definitions</u>
f(+/- 2) + f(+/- 3) + f(+/- 4) = 12%	w1 = player wins one unit
f(1.5) = 4.5%	l1 = player loses one unit
f(0) = 7%	
Therefore: f(1) + f(-1) = 76.5%	

Two linear equations and two unknowns to find w1 and l1:

Eq #1 w1 + l1 = 0.765

Eq #2

$$\frac{w1}{l1} = \frac{(pS)*(dB') + (pP)*(dB) + (pP)*(dP)*(pW)}{(pS)*(dP') + (pP)*(dP)*(dW) + pB}$$

$$\frac{w1}{l1} = \frac{(35\%)*(39.9\%) + (49\%)*(28\%) + (49\%)*(72\%)*(40\%)}{(35\%)*(60.1\%) + (49\%)*(72\%)*(40\%) + 16\%}$$

(w1/l1) = 41.8% / 51.1% = 81.8%

Solving:

w1 = 34.4% = f(1)

l1 = 42.1% = f(-1)

Maximum Probable Loss (MPL) and Bankroll for 2.3% Risk of Ruin

MPL = ABS(μ - 2*σ) when (μ - 2*σ) < 0, otherwise MPL = 0

Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5

Six Decks, 4.5 Decks Dealt

k = double & split factor k = 1.126

Number of Hands Played 200

(A)	(B)	(C)	(D)	(E) = (C) + (D)	Betting Schedule C (F1)	(F2)	(F3)=(F1)*(F2)*k	(F4) = (F3) * (E)	(F5)
Red 7 "tc"	Hand %	ba(t)	sg(t)	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (F2)*(F1)^2
2	43.0%	0.59%	0.07%	0.66%	1	86	97	0.64	86
3	24.9%	1.08%	0.13%	1.21%	2	50	112	1.36	199
4	14.3%	1.58%	0.32%	1.90%	3	29	97	1.84	258
5	7.9%	2.07%	0.64%	2.71%	4	16	71	1.93	254
6	4.5%	2.57%	1.02%	3.59%	4	9	41	1.46	145
7	2.6%	3.06%	1.40%	4.46%	4	5	24	1.06	85
8	1.5%	3.56%	1.78%	5.34%	4	3	14	0.73	48
9	0.8%	4.05%	2.16%	6.21%	4	2	7	0.42	24
10	0.4%	4.55%	2.54%	7.09%	4	1	3	0.24	12
Total	100.0%	n/a	n/a	n/a	n/a	200	466	9.69	1,111

μ proportional to hands played, "n"
σ proportional to square root of "n"
(σ/μ) proportional to SQRT(n) / n = 1.0 / (SQRT(n))
So if "n" quadruples, then μ quadruples, σ doubles and (σ/μ) halves.
column (B): Exhibit F1d

Players Advantage = 9.69 / 466 = **2.08%** SQRT:
Standard Deviation = SQRT(Tot (F5)) * 1.17 **39.0** 33.3
Standard Deviation / Expected Win 0.19
columns (C), (D) and (E): Exhibit F1a
column (F2) = (Number of Hands Played) * Column (B)

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) (i)

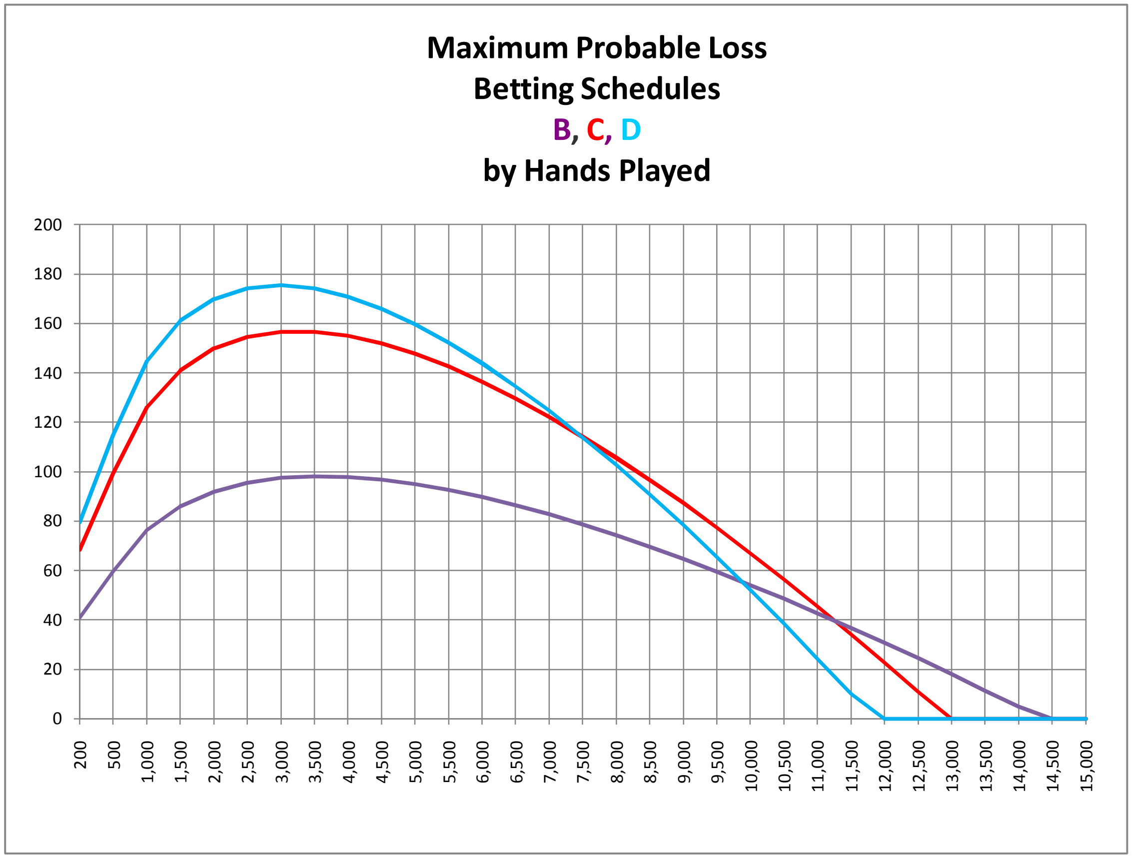
Maximum MPL occurs when (σ/μ) = 1.0 — MPL = 0 occurs when (σ/μ) = 0.5

Betting Schedule C

Hands Played	Amount Bet	μ = Exp. Win	σ = Std Dev	(σ/μ)	(μ - 2*σ)	MPL	Bankroll	Risk of Ruin	
200	466	9.7	39.0	4.02	-68.3	68	79	2.5%	(base)
500	1,164	24.2	61.7	2.55	-99.1	99	118	2.5%	
1,000	2,328	48.5	87.2	1.80	-125.9	126	155	2.5%	
1,500	3,493	72.7	106.8	1.47	-140.9	141	180	2.5%	
2,000	4,657	96.9	123.3	1.27	-149.7	150	198	2.5%	
2,500	5,821	121.1	137.9	1.14	-154.6	155	212	2.5%	
3,000	6,985	145.4	151.0	1.04	-156.7	157	224	2.5%	
3,500	8,150	169.6	163.1	0.96	-156.7	157	233	2.5%	
4,000	9,314	193.8	174.4	0.90	-155.0	155	240	2.5%	
4,500	10,478	218.0	185.0	0.85	-151.9	152	247	2.5%	
5,000	11,642	242.3	195.0	0.80	-147.7	148	252	2.5%	
5,500	12,807	266.5	204.5	0.77	-142.5	143	257	2.5%	
6,000	13,971	290.7	213.6	0.73	-136.5	136	260	2.5%	
6,500	15,135	314.9	222.3	0.71	-129.7	130	263	2.5%	
7,000	16,299	339.2	230.7	0.68	-122.3	122	266	2.5%	
7,500	17,464	363.4	238.8	0.66	-114.2	114	269	2.5%	
8,000	18,628	387.6	246.6	0.64	-105.7	106	272	2.5%	
8,500	19,792	411.8	254.2	0.62	-96.6	97	275	2.5%	
9,000	20,956	436.1	261.6	0.60	-87.1	87	275	2.5%	
9,500	22,121	460.3	268.8	0.58	-77.2	77	276	2.5%	
10,000	23,285	484.5	275.8	0.57	-67.0	67	278	2.5%	
10,500	24,449	508.7	282.6	0.56	-56.4	56	280	2.5%	
11,000	25,613	533.0	289.2	0.54	-45.5	45	282	2.5%	
11,500	26,778	557.2	295.7	0.53	-34.2	34	282	2.5%	
12,000	27,942	581.4	302.1	0.52	-22.7	23	282	2.5%	
12,500	29,106	605.6	308.3	0.51	-11.0	11	282	2.5%	
13,000	30,270	629.9	314.4	0.50	1.1	0	283	2.5%	
13,500	31,435	654.1	320.4	0.49	13.3	0	284	2.5%	
14,000	32,599	678.3	326.3	0.48	25.8	0	285	2.5%	
14,500	33,763	702.5	332.0	0.47	38.5	0	286	2.5%	
15,000	34,927	726.8	337.7	0.46	51.3	0	287	2.5%	
15,500	36,091	751.0	343.3	0.46	64.4	0	287	2.5%	
16,000	37,256	775.2	348.8	0.45	77.6	0	287	2.5%	
16,500	38,420	799.5	354.2	0.44	91.0	0	287	2.5%	
17,000	39,584	823.7	359.5	0.44	104.6	0	287	2.5%	
17,500	40,748	847.9	364.8	0.43	118.3	0	287	2.5%	
18,000	41,913	872.1	370.0	0.42	132.2	0	287	2.5%	
18,500	43,077	896.4	375.1	0.42	146.2	0	287	2.5%	

(i) Blackjack Forum, March 1994, "The Gospel According to Don". "Premature Bumping into the Barrier".
Maximum Drawdown (most units ever behind) ≈ 2*(MPL). (MPL for "h" hands is at the end of playing "h" hands)
Required Bankroll calculated from formula above using a 2.5% risk of ruin:
R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp Win, σ = Std Dev, B = Bankroll,
N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)
Let μ(h) = Exp Win when h hands are played μ(h2) = μ(h1) * (h2/h1) h1 was taken as the first entry in table above, 200 hands played.
Let σ(h) = Std Dev when h hands are played σ(h2) = σ(h1) * SQRT(h2/h1) μ(h2) and σ(h2) were calculated for each h2 from these formulas.

Maximum Probable Loss (MPL)
MPL = ABS(μ - 2*σ) when (μ - 2*σ) < 0, otherwise MPL = 0
Six Decks, 4.5 Decks Dealt

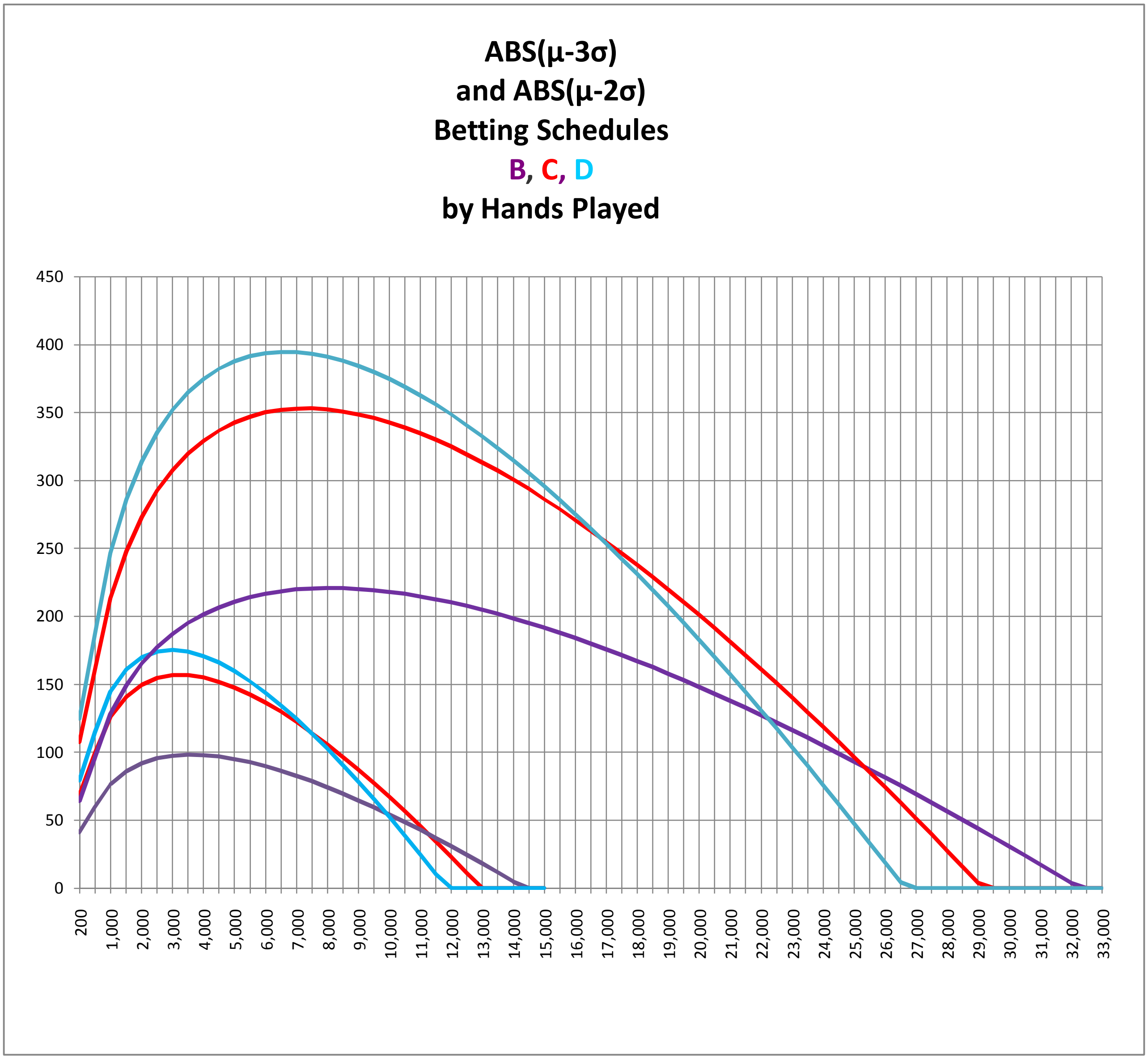


Red 7 "tc"	B	C	D
2	1	1	1
3	1	2	2
4	2	3	3
5	2	4	4
6	2	4	5
7	2	4	6
8	2	4	7
9	2	4	8
10	2	4	9
% adv	1.8%	2.1%	2.3%

If MPL is thought of as "risk" and if the long run is thought of as occurring when MPL = 0, then B has less risk initially than C but as hands played increases C has less risk for B. The MPL graph of C is above B (more risk) for hands played < 11,250 and C is below B (less risk) at hands played > 11,250. C hits the long run at 13,000 hands and B does not hit the long run until 14,500 hands. Likewise, D is initially more risky than C but at > 7,500 hands D is less risky than C and D reaches the long run at 12,000 hands as compared to C which takes 13,000 hands to reach the long run. B can be thought of as timid betting with 1.8% advantage, C is moderate betting with 2.1% and D is aggressive betting with 2.3%.

Exhibit F1c

Six Decks, 4.5 Decks Dealt



Red 7 "tc"	B	C	D
2	1	1	1
3	1	2	2
4	2	3	3
5	2	4	4
6	2	4	5
7	2	4	6
8	2	4	7
9	2	4	8
10	2	4	9
% adv	1.8%	2.1%	2.3%

X = amount won $P(X <= \mu-2\sigma) = 2.3\%$ $P(X <= \mu-3\sigma) = 0.13\%$

For Betting Schedule C:

If maximum loss is ABS(μ-2σ):

maximum loss occurs at ≈3,500 hands played (3.5 weeks) and is ≈ 157 units

long run ($\mu-2\sigma = 0$) occurs at ≈ 13,000 hands played (13 weeks or 3 months,1 week)

Losing streak can last as long as 3 months, 1 week.

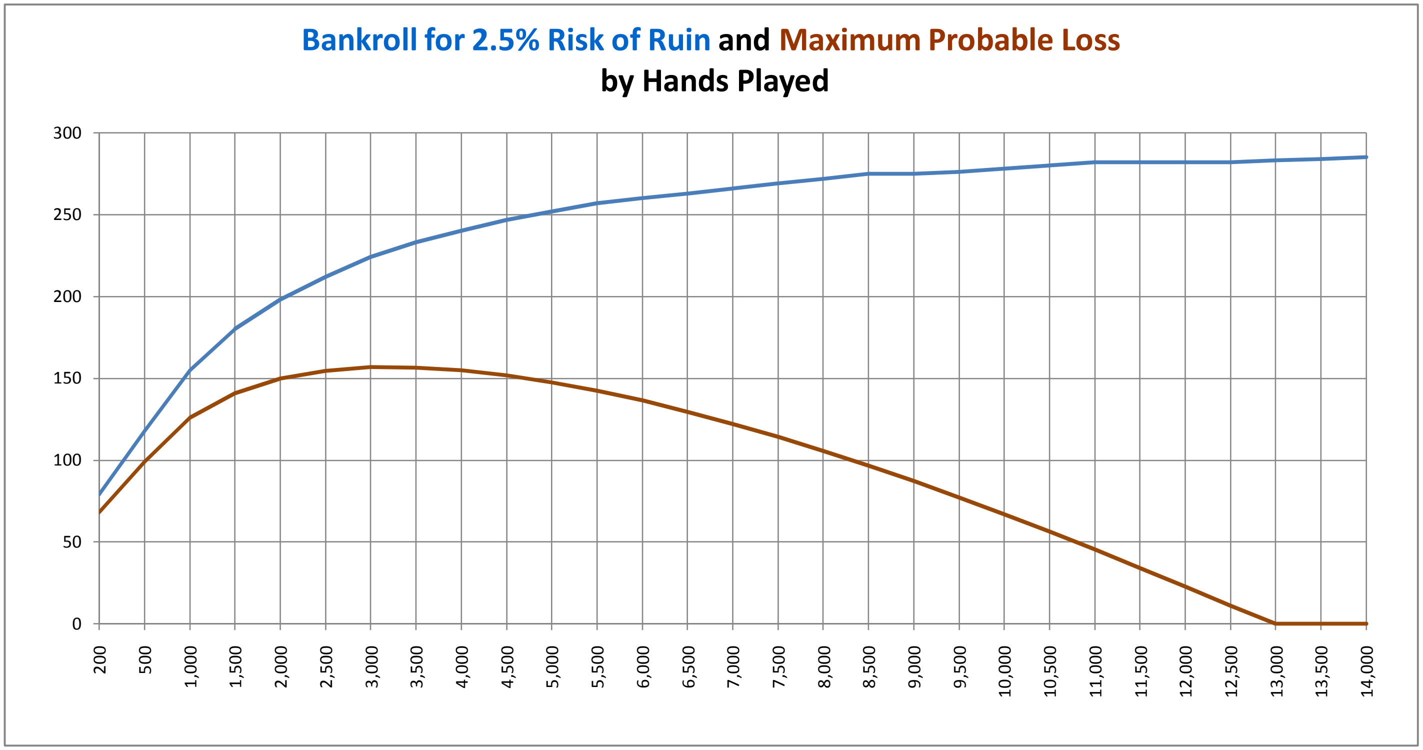
If maximum loss is ABS(μ-3σ):

maximum loss occurs at ≈7,500 hands played (7.5 weeks) and is ≈ 355 units

long run ($\mu-3\sigma = 0$) occurs at ≈ 29,000 hands played (29 weeks or 7 months, 1 week)

Losing streak can last as long as 7 months, 1 week.

Bankroll for 2.5% Risk of Ruin, in Units
By Hands Played
Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5
Six Decks, 4.5 Decks Dealt



Max Prob Loss = ABS(μ - 2*σ), if (μ - 2*σ) < 0, otherwise MPL = 0. If MPL > 0, P(Win <= (-1)*MPL) = P(Win <= μ - 2*σ) = NORMDIST(μ - 2*σ,0,1,TRUE) = 2.3%

MPL first equals zero at approximately 13,000 hands or around 13 weeks of play assuming 25 hands played / hour and 40 hours played per week.

≈ 2.5% Risk of Ruin, 25 hands played/hour, 40 hours/week								
Hands Played	Hours Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	P(Loss) (i)	Max Probable Loss	Risk of Ruin
200	8	Day	80	9.7	39.0	40%	68	2.4%
500	20	Weekend	120	24.2	61.7	35%	99	2.3%
1,000	40	1 week	160	48.5	87.2	29%	126	2.1%
2,000	80	2 weeks	200	96.9	123.3	22%	150	2.4%
4,000	160	1 month	240	193.8	174.4	13%	155	2.5%
8,000	320	2 months	280	387.6	246.6	6%	106	2.2%

(i) P(Loss) = P(Win <= 0) = NORMDIST(0,μ,σ,TRUE) = NORMDIST((0-μ)/σ,0,1,TRUE) h = hands played: μ(h2) = μ(h1) * (h2/h1), σ(h2) = σ(h1) * SQRT(h2/h1)

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

Bankroll and Bet Sizing
By Hands Played
Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5
Six Decks, 4.5 Decks Dealt

Because of covariance, amount bet one each of two hands should be 75% of the amount bet on one hand.
So total amount bet on the two hands is 150% of the amount bet on one hand.

Betting Schedule C for One Hand per Round

			k = double & split factor		k =	1.126	
Number of Hands Played		200	Betting Schedule C				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1.00	86	97	0.64	86
3	24.9%	1.21%	2.00	50	112	1.36	199
4	14.3%	1.90%	3.00	29	97	1.84	258
5	7.9%	2.71%	4.00	16	71	1.93	254
6	4.5%	3.59%	4.00	9	41	1.46	145
7	2.6%	4.46%	4.00	5	24	1.06	85
8	1.5%	5.34%	4.00	3	14	0.73	48
9	0.8%	6.21%	4.00	2	7	0.42	24
10	0.4%	7.09%	4.00	1	3	0.24	12
Total	100.0%	n/a	n/a	**200**	466	**9.69**	1,111

Column (5) = (# of Hands Played) * Column (2)
tpa(t) = total player advantage at true count "t"
= betting advantage (ba) + strategy gain (sg)

Players Advantage = 9.69 / 466	**2.08%**	SQRT:
Standard Deviation = SQRT(Tot (8)) * 1.17	**39.0**	33.3
Standard Deviation / Expected Win = 39 / 9.7	4.0	

Players Advantage = (Total Expected Win) / (Total Amount Bet) = Tot (7) / Tot (6) = 9.69 / 466 = 2.08%

Average Units Bet per hand played	
Total Amount Bet (Tot (6))	466
Number of Hands Played	200
Avg Units Bet per hand played	2.33

Average Units Won per hand played	
Total Initial Win (Tot (7))	9.69
Number of Hands Played	200
Avg Units Won per hand played	0.048

Notes:
(1) Average Units Won per hand = (Average Units Bet per hand) * (% advantage) = (2.33 units bet per hand) * 2.08% = 0.048 units won.
(2) If one hour of play consist of 25 hands, then the expected amount won in one hour is 0.048 * 25 = 1.2 units and

One hour of play = 25 hands played of the six deck game, four and a half decks dealt:

μ(1) =	μ(one hour)	=	units won per hour played
σ(1) =	σ(one hours)	=	units for one hour played

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

μ(n) =	μ("n" hours)	=	n * μ(1)
σ(n) =	σ("n" hours)	=	SQRT(n) * σ(1)

8 hour of play = 200 hands played of the six deck game, four and a half decks dealt (calculated above):

μ(8) =	μ(8 hours)	=	9.7	=	8 * μ(1)
σ(8) =	σ(8 hours)	=	39.0	=	SQRT(8) * σ(1)

μ(1) and σ(1) (also calculated directly as 25 hands played later in this Exhibit)

μ(1) =	μ(8) / 8	=	9.7	/	8	=	1.2
σ(1) =	σ(8) / SQRT(8)	=	39.0	/	SQRT(8)	=	13.8

Bankroll and Bet Sizing
By Hands Played
Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5
Six Decks, 4.5 Decks Dealt

Bankroll for One Hand per Round, Betting Schedule C

≈ 2.5% Risk of Ruin, 25 hands played/hour, 40 hours/week							
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss	Risk of Ruin
25	Hour	30	1.2	13.8	46%	26	2.4%
200	Day	80	10	39	40%	68	2.4%
500	Weekend	120	24	62	35%	99	2.3%
1,000	1 week	160	48	87	29%	126	2.1%
2,000	2 weeks	200	97	123	22%	150	2.4%
4,000	1 month	240	194	174	13%	155	2.5%
8,000	2 months	280	388	247	6%	106	2.2%

P(Loss) = P(Win <= 0) = NORMDIST(0,μ,σ,TRUE) = NORMDIST((0-μ)/σ,0,1,TRUE)

MPL = Maximum Probable Loss = ABS(μ - 2*σ) if (μ - 2*σ) < 0, otherwise MPL = 0.

h = hands played: μ(h2) = μ(h1) * (h2/h1), σ(h2) = σ(h1) * SQRT(h2/h1)

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

If the given number of hands played consisted of two hands/round, then the amount bet on each hand should be 75% of the amount bet for a single hand per round indicated in Betting Schedule C. So if Sch C calls for a 3 unit bet, then the amount bet on each hand should be 75% * 3 units = 2.25 units for a total of 4.5 units bet which is 150% of the indicated 3 unit bet for a single hand.

Example #1:

Day Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
80	$25	$2,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Example #2:

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$25	$3,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Example #3:

One Week Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
160	$25	$4,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Example #4:

Two Weeks Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
200	$50	$10,000	1	$50	$100	$150	$200
		75%	2	$38	$75	$113	$150

Example #5:

One Month Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
240	$100	$24,000	1	$100	$200	$300	$400
		75%	2	$75	$150	$225	$300

Bankroll and Bet Sizing

By Hands Played

Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5

Six Decks, 4.5 Decks Dealt

Note:
Let μ(h) = Exp Win when h hands are played
Let σ(h) = Std Dev when h hands are played

Then:
μ(h2) = μ(h1) * (h2/h1)
σ(h2) = σ(h1) * SQRT(h2/h1)

Col (7):
Expected Win per hour:
1.2 units

(1)	(2) = (1) / 200	(3) = SQRT((2))	(4) = (2)*μ@200	(5) = (3)*σ@200	(6) = (1) / 25	(7) = (4) / (6)
Hands Played	h/200	SQRT(h/200)	μ = Exp. Win	σ = Std Dev	Hours Played	μ / hour
200	1.0	1.0	10	39	8	1.2
500	2.5	1.6	24	62	20	1.2
1,000	5.0	2.2	48	87	40	1.2
2,000	10.0	3.2	97	123	80	1.2
4,000	20.0	4.5	194	174	160	1.2
8,000	40.0	6.3	388	247	320	1.2

Col (6): 25 hands played / hour

X = amount won from a single hand of blackjack.
Assume all Xi's are i.i.d. (identically & independently distributed)
Let Yh1 = X1 + X2 + … + Xh1 and Yh2 = X1 + X2 + … + Xh2
E(Yh1) = h1*E(X) and E(Yh2) = h2*E(X)
Var(Yh1) = h1*Var(X) and Var(Yh2) = h2*Var(X)
SD(Yh1) = SQRT(h1)*SD(X) and SD(Yh2) = SQRT(h2)*SD(X)
Then

$$\frac{E(Yh2)}{E(Yh1)} = \frac{h2*E(X)}{h1*E(X)} = \frac{h2}{h1}$$

μ(h2) = μ(h1) * (h2/h1)

The expected value of the amount won increases proportional to the number of hands played.

$$\frac{SD(Yh2)}{SD(Yh1)} = \frac{SQRT(h2)*SD(X)}{SQRT(h1)*SD(X)} = \frac{SQRT(h2)}{SQRT(h1)} = SQRT(h2/h1)$$

σ(h2) = σ(h1) * SQRT(h2/h1)

The standard deviation of the amount won increases proportional to the square root of the number of hands played.

Bankroll for One Hand per Round, Betting Schedule C

≈ 2.5% Risk of Ruin, 25 hands played/hour, 40 hours/week							
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss	Risk of Ruin
200	Day	80	10	39	40%	68	2.4%
500	Weekend	120	24	62	35%	99	2.3%
1,000	1 week	160	48	87	29%	126	2.1%
2,000	2 weeks	200	97	123	22%	150	2.4%
4,000	1 month	240	194	174	13%	155	2.5%
8,000	2 months	280	388	247	6%	106	2.2%

P(Loss) = P(Win <= 0) = NORMDIST(0,μ,σ,TRUE) = NORMDIST((0-μ)/σ,0,1,TRUE)
MPL = Maximum Probable Loss = ABS(μ - 2*σ) if (μ - 2*σ) < 0, otherwise MPL = 0.
R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)   R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,
N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

Bankroll and Bet Sizing
By Hands Played
Betting Schedule C: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5
Six Decks, 4.5 Decks Dealt

Betting Schedule C for One Hand per Round
One Hour Played = 25 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		**25**	**Betting Schedule C**				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1.00	11	12	0.08	11
3	24.9%	1.21%	2.00	6	14	0.17	25
4	14.3%	1.90%	3.00	4	12	0.23	32
5	7.9%	2.71%	4.00	2	9	0.24	32
6	4.5%	3.59%	4.00	1	5	0.18	18
7	2.6%	4.46%	4.00	1	3	0.13	11
8	1.5%	5.34%	4.00	0	2	0.09	6
9	0.8%	6.21%	4.00	0	1	0.05	3
10	0.4%	7.09%	4.00	0	0	0.03	2
Total	100.0%	n/a	n/a	**25**	58	**1.21**	139
Column (5) = (# of Hands Played) * Column (2)			Players Advantage = 1.21 / 58			**2.08%**	SQRT:
tpa(t) = total player advantage at true count "t"			Standard Deviation = SQRT(Tot (8)) * 1.17			**13.8**	11.8
= betting advantage (ba) + strategy gain (sg)			Standard Deviation / Expected Win = 13.8 / 1.2			11.4	

<u>One hour of play = 25 hands played of the six deck game, four and a half decks dealt:</u>

μ(one hour)	1.21	≈	**1.2**	units won per hour played
σ(one hour)	13.8	≈	**14**	units

<u>"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:</u>

μ("n" hours)	=	n * μ(one hour)	=	n * 1.2
σ("n" hours)	=	SQRT(n) * σ(one hour)	=	SQRT(n) * 14

So given number of hours played, μ and σ can be calculated from μ and σ for one hour of play using above equations. Then the risk formula: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used given either "B" in which case "R" is calculated or given "R" in which case "B" is calculated.

<u>Example:</u>
Day trip = 8 hours of play:

μ(8 hours)	=	8 * μ(one hour)	=	8 * 1.2
μ(8 hours)	=	9.7		
σ(8 hours)	=	SQRT(8) * σ(one hour)	=	SQRT(8) * 14
σ(8 hours)	=	39		

Notice that μ and σ calculated for 8 hours of play or 200 hands played from hourly μ and σ agree with direct calculation of μ and σ for 200 hands played (8 hours of play * 25 hands per hour) as shown in a previous table.

So μ and σ for a days play (8 hours of 200 hands) is now known and if risk of ruin, R, is desired to be approximately 2.5%, then the risk formula, R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used to calculated what "B" should be.

Risk of Ruin Examples

Betting Schedule C

≈ 2.5% Risk of Ruin, 25 hands played/hour, 40 hours/week							
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss	Risk of Ruin
200	Day	80	10	39	40%	68	2.4%
500	Weekend	120	24	62	35%	99	2.3%
1,000	1 week	160	48	87	29%	126	2.1%
2,000	2 weeks	200	97	123	22%	150	2.4%
4,000	1 month	240	194	174	13%	155	2.5%
8,000	2 months	280	388	247	6%	106	2.2%

<u>Example:</u>

Player #1

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$25	$3,000	1	$25	$50	$75	$100
		75%	2	$19	$38	$56	$75

Player #2

Weekend Trip, 2.5% Risk of Ruin				True Counts			
# of Units	Unit Size	Bankroll	# hands	2	3	4	5
120	$33	$4,000	1	$33	$67	$100	$133
		75%	2	$25	$50	$75	$100

(Player #2 Bankroll) = (4/3) * (Player #1 Bankroll)
Day trip player #1 with a $3,000 bankroll can bet $25, $50, $75 and $100 on a single hand with a 2.5% Risk of Ruin.
Day trip player #2 with a $4,000 bankroll can bet $25, $50, $75 and $100 on <u>*each*</u> of two hands with a 2.5% Risk of Ruin.
If Player #1 played two hands at $25, $50, $75 and $100, his risk of ruin would increase to 8%. See explanation below.

Risk of Ruin Examples

Betting Schedule C with original 2.5% RoR Bankroll Cut by 25%

25% cut in bankroll increases Risk or Ruin from 2.5% to approximately 8%

Two hands played without any reduction in amount bet per hand

Hands Played	Trip Duration	**75% Bankroll**	μ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss	Risk of Ruin
200	Day	60	10	39	40%	68	8.3%
500	Weekend	90	24	62	35%	99	7.7%
1,000	1 week	120	48	87	29%	126	7.1%
2,000	2 weeks	150	97	123	22%	150	7.2%
4,000	1 month	180	194	174	13%	155	7.0%
8,000	2 months	210	388	247	6%	106	6.0%

Example: One week player's unit bet size is $25 and since player needs, for a 2.5% risk of ruin, a 160 unit bankroll, then player brings a $4,000 bankroll. Player decides to play two hands at the same bet size as indicated for one hand instead of reducing the bet for each hand to 75% of the bet size for one hand. For example, a true count of 3 calls for a 2 unit bet or $50 on one hand or 75%*50 ≈ $40 on each of two hands. Instead of betting $40 on each of the two hands, the player decides to still bet $50 on each hand. Betting $50 on each of two hands is equivalent to betting (4/3)*$50 ≈ $67 on one hand. Since for a true count of 3, a two unit bet is called for when playing one hand and player is now betting an equivalent single hand bet of $67 (when betting two hands at $50 each), then a two unit bet for a single hand is now $67 which makes the unit bet size ($67/2) = $33.50. A $4,000 bankroll with a unit bet size of $33.50 is a 120 unit bankroll. So the number of units in the bankroll is now actually 120 units instead of 160 units so the bankroll is effectively cut by 25% and the risk of ruin is increased from 2.5% to 7.1%. If an 8% risk of ruin is still acceptable, then play two hands at the bet amount indicated for one hand. The amount bet and so the expected winnings will increase by 33% and the risk will increase from 2.5% to 8%.

Risk of Ruin Examples

Betting Schedule C with original 2.5% RoR Bankroll Cut by 50%

50% cut in bankroll increases Risk or Ruin from 2.5% to approximately 20%

Unit bet size is doubled to double the hourly win rate with no increase in original bankroll

Hands Played	Trip Duration	**50% Bankroll**	µ = Exp. Win	σ = Std Dev	P(Loss)	Max Probable Loss	Risk of Ruin
200	Day	40	10	39	40%	68	23.3%
500	Weekend	60	24	62	35%	99	21.7%
1,000	1 week	80	48	87	29%	126	20.0%
2,000	2 weeks	100	97	123	22%	150	19.2%
4,000	1 month	120	194	174	13%	155	18.0%
8,000	2 months	140	388	247	6%	106	15.8%

Example: Day trip player's unit bet size is $25 and since player needs, for a 2.5% risk of ruin, a 80 unit bankroll , then player brings a $2,000 bankroll. Player decides to double his hourly win rate by doubling his unit bet size. So player's new unit bet size is now $50 and player's $2,000 original bankroll is now actually 40 $50 units as opposed to 80 $25 units as originally planned. Player's new risk of ruin is now 23.3% using the $50 unit bet size as compared to 2.5% using the $25 unit bet size.

Bankroll for various Risk of Ruin
Betting Schedule C

25 hands played/hour, 40 hours/week					Bankroll by Risk of Ruin			
Hands Played	Trip Duration	μ = Exp. Win	σ = Std Dev	σ / μ	**2.5%**	**5.0%**	**10.0%**	**20.0%**
200	Day	10	39	4.0	79	69	57	44
500	Weekend	24	62	2.5	118	102	83	63
1,000	1 week	48	87	1.8	155	133	108	80
2,000	2 weeks	97	123	1.3	198	167	134	98
4,000	1 month	194	174	0.9	240	200	158	113
8,000	2 months	388	247	0.6	272	224	174	122

Risk of Ruin ≈ 2.5%								
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	σ / μ	P(Loss)	Max Probable Los	Risk of Ruin
200	Day	79	10	39	4.0	40%	68	2.5%
500	Weekend	118	24	62	2.5	35%	99	2.5%
1,000	1 week	155	48	87	1.8	29%	126	2.5%
2,000	2 weeks	198	97	123	1.3	22%	150	2.5%
4,000	1 month	240	194	174	0.9	13%	155	2.5%
8,000	2 months	272	388	247	0.6	6%	106	2.5%

Risk of Ruin ≈ 5.0%								
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	σ / μ	P(Loss)	Max Probable Los	Risk of Ruin
200	Day	69	10	39	4.0	40%	68	4.8%
500	Weekend	102	24	62	2.5	35%	99	4.9%
1,000	1 week	133	48	87	1.8	29%	126	4.9%
2,000	2 weeks	167	97	123	1.3	22%	150	5.0%
4,000	1 month	200	194	174	0.9	13%	155	5.0%
8,000	2 months	224	388	247	0.6	6%	106	5.0%

Risk of Ruin ≈ 10.0%								
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	σ / μ	P(Loss)	Max Probable Los	Risk of Ruin
200	Day	57	10	39	4.0	40%	68	9.8%
500	Weekend	83	24	62	2.5	35%	99	10.0%
1,000	1 week	108	48	87	1.8	29%	126	9.9%
2,000	2 weeks	134	97	123	1.3	22%	150	10.0%
4,000	1 month	158	194	174	0.9	13%	155	9.9%
8,000	2 months	174	388	247	0.6	6%	106	9.9%

Risk of Ruin ≈ 20.0%								
Hands Played	Trip Duration	Bankroll	μ = Exp. Win	σ = Std Dev	σ / μ	P(Loss)	Max Probable Los	Risk of Ruin
200	Day	44	10	39	4.0	40%	68	19.2%
500	Weekend	63	24	62	2.5	35%	99	19.7%
1,000	1 week	80	48	87	1.8	29%	126	20.0%
2,000	2 weeks	98	97	123	1.3	22%	150	19.9%
4,000	1 month	113	194	174	0.9	13%	155	20.0%
8,000	2 months	122	388	247	0.6	6%	106	20.1%

Exhibit F1c

Approximation
2.5% Risk of Ruin as Base
Bankroll for various Risk of Ruin
Betting Schedule C, 6 Decks, 4.5 Dealt
1-4 spread, 25 hands played/hour, 40 hours/week

Actual Bankroll by Risk of Ruin

	Risk of Ruin				
Trip Duration	2.5%	5%	10%	15%	20%
Day	79	69	57	49	44
Weekend	118	102	83	71	63
1 week	155	133	108	92	80
2 weeks	198	167	134	113	98
1 month	240	200	158	132	113
2 months	272	224	174	143	122

Ratios to 2.5% Risk of Ruin

Trip	≈2.5%	10% Risk of Ruin		20% Risk of Ruin	
Duration	Risk of Ruin	Bankroll	% of 2.5%	Bankroll	% of 2.5%
Day	80	57	71%	44	55%
Weekend	120	83	69%	63	53%
1 week	160	108	68%	80	50%
2 weeks	200	134	67%	98	49%
1 month	240	158	66%	113	47%
2 months	280	174	62%	122	44%
Average	n/a	n/a	**67%**	n/a	**50%**

Approximate Bankroll by Risk of Ruin 25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt					
	Risk of Ruin				
(1)	(2)	(3) = Avg((2),(4))	(4) = 67% * (2)	(5) = Avg((4),(6))	(6) = 50% * (2)
Trip Duration	2.5%	5%	10%	15%	20%
Day	80	67	54	47	40
Weekend	120	100	80	70	60
1 week	160	134	107	94	80
2 weeks	200	167	134	117	100
1 month	240	200	161	140	120
2 months	280	234	188	164	140

The recommended 2.5% Risk of Ruin Bankroll column in the chart above should be memorized.
Then the rest of the Risk of Ruin table can be quickly constructed.

<u>Example:</u>
One week trip bankroll for $25 tables is $2,500 so bankroll is 100 units. Using appoxmation above, 10% risk of ruin is 107 units and 15% risk of ruin is 94 units so risk of ruin is greater than 10% and less than 15%.

One Week Trip, Recommended 2.5% Risk of Run Bankroll = 160 units	
X = Bankroll, in units	Y = Risk of Ruin
107	10%
100	y
94	15%

(y - 10%) / (15% - 10%) = (100 - 107) / (94 - 107)
y = 10% + (7/13)*(5%) = 12.7%   Actual Risk of Ruin is 12.2%

Summary

2.5% Risk of Ruin as Base

Bankroll for various Risk of Ruin

Betting Schedule C, 6 Decks, 4.5 Dealt

1-4 spread, 25 hands played/hour, 40 hours/week

Suggested 2.5% Risk of Ruin Bankroll by Trip Duration						
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt						
Trip Duration	Hours Played	Hands Played	μ = Exp. Win	σ = Std Dev	σ / μ	Bankroll
Day	8	200	10	39	4.1	80
Weekend	20	500	24	62	2.6	120
1 week	40	1,000	48	87	1.8	160
2 weeks	80	2,000	96	123	1.3	200
1 month	160	4,000	192	175	0.9	240
2 months	320	8,000	384	247	0.6	280

$\mu(1) = 1.2$, $\sigma(1) = 13.8$, $\mu(n) = n*\mu(1)$, and $\sigma(n) = SQRT(n)*\sigma(1)$ where n = hours played

Approximate Bankroll for 2.5%, 10% and 20% Risk of Ruin						
25 hands played/hour, 40 hours/week, 1-4 spread, 6 decks, 4.5 dealt						
(1)	(2)	(3)	(4)	(5)	(6) = 67%*(5)	(7) = 50%*(5)
Trip Duration	Hours Played	Hands Played	P(Loss)	≈2.5%	≈10%	≈20%
Day	8	200	40%	80	53	40
Weekend	20	500	35%	120	80	60
1 week	40	1,000	29%	160	107	80
2 weeks	80	2,000	22%	200	133	100
1 month	160	4,000	13%	240	160	120
2 months	320	8,000	6%	280	187	140

≈2.5% Risk of Ruin Bankrolls

≈ 2.5% Risk of Ruin (RoR)							
25 hands played/hour, 40 hours/week, 6 decks, 4.5 dealt							
Hands Played	Trip Duration	Hours Played	Bet Sch S4	Bet Sch S3	S3 / S4	Bet Sch S2	S2 / S4
200	Day	8	80	70	88%	56	70%
500	Weekend	20	120	105	88%	84	70%
1,000	1 week	40	160	138	86%	111	69%
2,000	2 weeks	80	200	177	89%	143	72%
4,000	1 month	160	240	216	90%	176	73%
8,000	2 months	320	280	246	88%	204	73%
			Average		88%		71%
			Average Rounded		**90%**		**75%**

Method 1: Switch Betting Schedules, Leave Unit Bet Size unchanged

	Bankroll as % of 2.5% Betting Schedule S4 Bankroll		
	> 90%	<= 90%	<= 75%
	Betting Schedule (Units Bet)		
Red 7 tc	S4	S3	S2
2	1	1	1
3	2	2	2
4	3	3	2
>= 5	4	3	2

If (Current Bank) > 0.90*(Initial Bank), then Betting Schedule S4
If 0.75*(Initial Bank) < (Current Bank) <= 0.90*(Initial Bank), then Betting Schedule S3
If (Current Bank) <= 0.75*(Initial Bank), then Betting Schedule S2

Method 2: Reduce Unit Bet Size, Bet Sch S4 unchanged

(Current Bank) > 0.90*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size unchanged

0.75*(Initial Bank) < (Cur Bank) <= 0.90*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size = 0.80*(Initial Unit Bet Size)

(Current Bank) <= 0.75*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size = 0.60*(Initial Unit Bet Size)

	Betting Schedule S4							
	Bet on each of 2 hands is 75% of the bet on a single hand							
	Units Bet		Day Trip Bank = $1,200		Day Trip Bank = $1,600		Day Trip Bank = $2,000	
Red 7 True Count	1 hand	each of 2 hands	1 hand	each of 2 hands	1 hand	each of 2 hands	1 hand	each of 2 hands
2	1	0.75	$15	$10 or $15	$20	$15	$25	$20 or $25
3	2	1.50	$30	$20 or $25	$40	$30	$50	$35 or $40
4	3	2.25	$45	$30 or $35	$60	$45	$75	$55 or $60
>= 5	4	3.00	$60	$45	$80	$60	$100	$75

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

Red 7 "tc"	Hand %	Units Bet	tpa(t)
2	43.0%	1	0.66%
3	24.9%	2	1.21%
4	14.3%	3	1.90%
5	7.9%	4	2.71%
6	4.5%	4	3.59%
7	2.6%	4	4.46%
8	1.5%	4	5.34%
9	0.8%	4	6.21%
10	0.4%	4	7.09%
Total / Avg	100.0%	2.07	2.08%
Average Bet	2.07	12%: db & sp	2.32

Red 7 "tc"	Hand %	Units Bet	a	p = (a+1)/2 *	#'s between	#'s Difference
2	43.0%	1	0.66%	0.503	430	430
3	24.9%	2	1.21%	0.506	679	249
4	14.3%	3	1.90%	0.509	822	143
>= 5	17.7%	4	3.66%	0.518	1000	178
Total / Avg	100.0%	2.07	2.08%	n/a	n/a	1,000

* outcomes +1 with prob "p" and -1 with prob (1-p), then EV = (+1)*p + (-1)*(1-p) = a (advantage), so p = (a + 1)/2.

(5) Initial Bet = 1 if (4) <= 430, 2 if 430 < (4) <= 679, 3 if 679 < (4) <= 822, 4 if 822 < (4).

Doubling (10%) and Splitting (2%) occur a total of 12% of the time: (7) = (5)*2 if (6) <= 12 and (11) = (10)*2 if (6) <= 12.

(8) Amount Won = (7)*(2a) if (5) = 1, (7)*(2b) if (5) = 2, (7)*(2c) if (5) = 3, (7)*(2d) if (5) = 4.

(11) Modified Initial Bet, column (11), based on current bankroll, column(14):

If B:prev <= 90%*B:initial, then (11) = min((5),3); If B:prev <= 75%*B:initial, then (11) = min((5),2).

Hands Played	Trip Duration	Hours Played	Bet Sch S4
200	Day	8	80
500	Weekend	20	120
1,000	1 week	40	160
2,000	2 weeks	80	200
4,000	1 month	160	240
8,000	2 months	320	280

	Bank as % of 2.5% Bet Sch S4 Bank		
	> 90%	<= 90%	<= 75%
	Betting Schedule (Units Bet)		
Red 7 tc	S4	S3	S2
2	1	1	1
3	2	2	2
4	3	3	2
>= 5	4	3	2

If (Current Bank) > 0.90*(Initial Bank), then Betting Schedule S4

If 0.75*(Initial Bank) < (Current Bank) <= 0.90*(Initial Bank), then Betting Schedule S3

If (Current Bank) <= 0.75*(Initial Bank), then Betting Schedule S2

Theoretical Risk of Ruin

Betting Schedule S4, 8 hours, initial bankroll 80 units

μ(1)	1.2	σ(1)	13.8	
hours	μ(n) = n*μ(1)		μ(n)	9.6
8	σ(n) = SQRT(n)*σ(1)		σ(n)	39.0
	Bankroll		B	80

$R = N((-B - \mu)/\sigma) + EXP((-2*\mu*B)/\sigma^2) * N((-B + \mu)/\sigma)$

R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll

N(x) = area to the left of "x" for the standard NORMDIST with mean 0 and std dev 1.

(1)	N((-B - μ)/σ)	0.011
(2)	EXP((-2*μ*B)/σ^2)	0.365
(3)	N((-B + μ)/σ)	0.036
	R = (1) + (2)*(3)	**2.39%**

Simulated Risk of Ruin

Unmodified Betting: 1-4 Betting Schedule S4 not modified as Bankroll changes.
Ruin if Column (9) Bankroll <= 0 at any point during the trip.

Modified Betting: 1-4 spread reduced to 1-3 or 1-2 depending on Bankroll.
Ruin if Column (14) Bankroll <= 0 at any point during the trip.

Unmodified Bet Spread	
Number of Simulated Trips	250,000
Number of Bankruptcies	5,436
Risk of Ruin	**2.17%**

Modified Bet Spread	
Number of Simulated Trips	140,000
Number of Bankruptcies	482
Risk of Ruin	**0.34%**

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

Simulation Results: Day Trip (8 hours, 200 hands played, initial bankroll = 80 units)

	Risk of Ruin (RoR)			Ending Bankroll					
1- 4 Bet Spread	# Trips	# bankrupt	RoR	# Trips	Average	Profit	Std Dev	Skew	Kurt *
Unmodified Bet Spread	250,000	5,436	2.17%	100,000	89.56	9.56	38.92	0.004	0.010
Modified Bet Spread	140,000	482	0.34%	100,000	88.71	8.71	37.15	0.334	-0.248

* Excel function "KURT" (Kurtosis) is calculated so that the normal distribution as a kurtosis of 0, leptokurtic > 0 and platykurtic < 0.

Unmodified Bet Spread has skew ≈ 0 and KURT ≈ 0, similar to the normal distribution. Unmodified Bet Spread has Skew and KURT different from normal and so it not normally distributed.

	Minimum Bank during trip			Maximum	Prob of a losing trip		
1- 4 Bet Spread	# Trips	Average	Std Dev	Drawdown *	# Trips	Bank < 80	P(Loss)
Unmodified Bet Spread	100,000	54.95	21.24	25.05	160,000	63,887	39.9%
Modified Bet Spread	100,000	57.50	17.07	22.50	160,000	70,508	44.1%

* Average Maximum Drawdown during trip = 80 unit initial bankroll minus Average Minimum Bankroll during trip.

If X1 = Average Minimum Bank and X2= Maximum Drawdown, then X2 = 80 - X1 and so Variance(X2) = Variance(80 - X1) = Variance(X1) and so Std Dev(X2) = Std Dev(X1).

Profit = (Average Advantage) * (Average Bet Size) * (# hands played)

	(1)	(2)	(3)	(4)	(5)	(6)
	Average Bet Size		Profit		# hands	= (4) / { (2) * (5) }
1- 4 Bet Spread	# Trips	Average	# Trips	Average	per trip	Average Advantage
Unmodified Bet Spread	21,000	2.32	100,000	9.56	200	2.06%
Modified Bet Spread	21,000	2.19	100,000	8.71	200	1.99%

(2) Average Bet Size calculated by calculating and saving the average final bet column (7) and modified final bet column (12) and averaging for all trips in the simulation.

Unmodified Expected Win and Standard Deviation: Simulation (100,000 trips) vs. Theory

	Theory	Simulation
Exp Win	9.60	9.56
Std Dev	39.03	38.92

μ(1)	expected one hour win	1.2
σ(1)	one hour standard deviation	13.8
μ(8)	= 8 * μ(1) =	9.6
σ(8)	= SQRT(8) * σ(1) =	39.0

Modified Betting Risk of Ruin using expected win and standard deviation from simulation in the RoR formula compared to simulated Risk of Ruin

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)

μ	8.71	(simulation results)	(1)	N((-B - μ)/σ)	0.008
σ	37.15	(simulation results)	(2)	EXP((-2*μ*B)/σ^2)	0.364
B	80	(initial bankroll)	(3)	N((-B + μ)/σ)	0.027
RoR	0.34%	(simulation results)		R = (1) + (2)*(3)	1.85%

Theoretical RoR assumes one normal distribution. For modified bet spread, simulated RoR is a combination of three normal distributions.

Thus the modified bet spread ending bankroll is not normally distributed and so the Theoretical Risk of Ruin formula cannot be used.

Results of Modified Bet Spread compared to Unmodified Bet Spread

Positives:

(1) Risk of Ruin decreased from 2.17% to 0.34%

(2) Standard Deviation of Profit decreased from 38.92 to 37.15

(3) Average Maximum Drawdown during trip decreased from 25.05 to 22.50 units

(4) Standard Deviation of Average Maximum Drawdown during trip decreased from 21.24 to 17.07

Negatives

(1) Profit per trip decreased from 9.56 to 8.71 which is a 9% decrease in profits

Average Bet Size decreased from 2.32 to 2.19 units

Average Advantage decreased from 2.06% to 1.99%

(2) Probability of a losing trip increased from 39.9% to 44.1%

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
											80
1	660	-1	-1	-1	-1	867	4	34	4	-4	76
2	834	-1	-1	-1	-1	441	2	55	2	-2	74
3	375	1	1	1	1	818	3	91	3	3	77
4	288	1	1	1	1	719	3	16	3	3	80
5	317	1	1	1	1	644	2	71	2	2	82
6	383	1	1	1	1	883	4	27	4	4	86
7	994	-1	-1	-1	-1	910	4	50	4	-4	82
8	580	-1	-1	-1	-1	669	2	35	2	-2	80
9	559	-1	-1	-1	-1	775	3	82	3	-3	77
10	79	1	1	1	1	982	4	36	4	4	81
11	185	1	1	1	1	673	2	32	2	2	83
12	137	1	1	1	1	314	1	10	2	2	85
13	533	-1	-1	-1	-1	685	3	30	3	-3	82
14	65	1	1	1	1	733	3	4	6	6	88
15	766	-1	-1	-1	-1	750	3	87	3	-3	85
16	990	-1	-1	-1	-1	657	2	78	2	-2	83
17	941	-1	-1	-1	-1	281	1	29	1	-1	82
18	30	1	1	1	1	10	1	83	1	1	83
19	871	-1	-1	-1	-1	786	3	84	3	-3	80
20	110	1	1	1	1	245	1	68	1	1	81
21	259	1	1	1	1	238	1	14	1	1	82
22	970	-1	-1	-1	-1	945	4	7	8	-8	74
23	641	-1	-1	-1	-1	742	3	3	6	-6	68
24	321	1	1	1	1	447	2	15	2	2	70
25	3	1	1	1	1	178	1	15	1	1	71

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
					80						80.0
1	4	4	4	-4	76	4	1.0	4.0	4.0	-4.0	76.0
2	2	2	2	-2	74	2	1.0	2.0	2.0	-2.0	74.0
3	3	3	3	3	77	3	1.0	3.0	3.0	3.0	77.0
4	3	3	3	3	80	3	1.0	3.0	3.0	3.0	80.0
5	2	2	2	2	82	2	1.0	2.0	2.0	2.0	82.0
6	4	4	4	4	86	4	1.0	4.0	4.0	4.0	86.0
7	4	4	4	-4	82	4	1.0	4.0	4.0	-4.0	82.0
8	2	2	2	-2	80	2	1.0	2.0	2.0	-2.0	80.0
9	3	3	3	-3	77	3	1.0	3.0	3.0	-3.0	77.0
10	4	4	4	4	81	4	1.0	4.0	4.0	4.0	81.0
11	2	2	2	2	83	2	1.0	2.0	2.0	2.0	83.0
12	1	1	2	2	85	1	1.0	1.0	2.0	2.0	85.0
13	3	3	3	-3	82	3	1.0	3.0	3.0	-3.0	82.0
14	3	3	6	6	88	3	1.0	3.0	6.0	6.0	88.0
15	3	3	3	-3	85	3	1.0	3.0	3.0	-3.0	85.0
16	2	2	2	-2	83	2	1.0	2.0	2.0	-2.0	83.0
17	1	1	1	-1	82	1	1.0	1.0	1.0	-1.0	82.0
18	1	1	1	1	83	1	1.0	1.0	1.0	1.0	83.0
19	3	3	3	-3	80	3	1.0	3.0	3.0	-3.0	80.0
20	1	1	1	1	81	1	1.0	1.0	1.0	1.0	81.0
21	1	1	1	1	82	1	1.0	1.0	1.0	1.0	82.0
22	4	4	8	-8	74	4	1.0	4.0	8.0	-8.0	74.0
23	3	3	6	-6	68	3	1.0	3.0	6.0	-6.0	68.0
24	2	2	2	2	70	2	0.8	1.6	1.6	1.6	69.6
25	1	1	1	1	71	1	0.8	0.8	0.8	0.8	70.4

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
26	153	1	1	1	1	49	1	43	1	1	72
27	637	-1	-1	-1	-1	622	2	26	2	-2	70
28	125	1	1	1	1	925	4	37	4	4	74
29	231	1	1	1	1	194	1	40	1	1	75
30	13	1	1	1	1	714	3	76	3	3	78
31	568	-1	-1	-1	-1	909	4	35	4	-4	74
32	571	-1	-1	-1	-1	716	3	23	3	-3	71
33	654	-1	-1	-1	-1	889	4	52	4	-4	67
34	830	-1	-1	-1	-1	249	1	86	1	-1	66
35	547	-1	-1	-1	-1	939	4	12	8	-8	58
36	450	1	1	1	1	952	4	68	4	4	62
37	554	-1	-1	-1	-1	77	1	49	1	-1	61
38	250	1	1	1	1	489	2	48	2	2	63
39	422	1	1	1	1	527	2	37	2	2	65
40	660	-1	-1	-1	-1	592	2	39	2	-2	63
41	348	1	1	1	1	975	4	19	4	4	67
42	238	1	1	1	1	288	1	48	1	1	68
43	679	-1	-1	-1	-1	480	2	98	2	-2	66
44	659	-1	-1	-1	-1	697	3	36	3	-3	63
45	508	-1	-1	1	1	644	2	98	2	-2	61
46	307	1	1	1	1	241	1	84	1	1	62
47	721	-1	-1	-1	-1	796	3	75	3	-3	59
48	107	1	1	1	1	233	1	91	1	1	60
49	418	1	1	1	1	111	1	51	1	1	61
50	226	1	1	1	1	505	2	30	2	2	63

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
26	1	1	1	1	72	1	0.8	0.8	0.8	0.8	71.2
27	2	2	2	-2	70	2	0.8	1.6	1.6	-1.6	69.6
28	4	3	3	3	73	4	0.8	3.2	3.2	3.2	72.8
29	1	1	1	1	74	1	1.0	1.0	1.0	1.0	73.8
30	3	3	3	3	77	3	1.0	3.0	3.0	3.0	76.8
31	4	4	4	-4	73	4	1.0	4.0	4.0	-4.0	72.8
32	3	3	3	-3	70	3	1.0	3.0	3.0	-3.0	69.8
33	4	3	3	-3	67	4	0.8	3.2	3.2	-3.2	66.6
34	1	1	1	-1	66	1	0.8	0.8	0.8	-0.8	65.8
35	4	3	6	-6	60	4	0.8	3.2	6.4	-6.4	59.4
36	4	2	2	2	62	4	0.6	2.4	2.4	2.4	61.8
37	1	1	1	-1	61	1	0.8	0.8	0.8	-0.8	61.0
38	2	2	2	2	63	2	0.8	1.6	1.6	1.6	62.6
39	2	2	2	2	65	2	0.8	1.6	1.6	1.6	64.2
40	2	2	2	-2	63	2	0.8	1.6	1.6	-1.6	62.6
41	4	3	3	3	66	4	0.8	3.2	3.2	3.2	65.8
42	1	1	1	1	67	1	0.8	0.8	0.8	0.8	66.6
43	2	2	2	-2	65	2	0.8	1.6	1.6	-1.6	65.0
44	3	3	3	-3	62	3	0.8	2.4	2.4	-2.4	62.6
45	2	2	2	-2	60	2	0.8	1.6	1.6	-1.6	61.0
46	1	1	1	1	61	1	0.8	0.8	0.8	0.8	61.8
47	3	3	3	-3	58	3	0.8	2.4	2.4	-2.4	59.4
48	1	1	1	1	59	1	0.6	0.6	0.6	0.6	60.0
49	1	1	1	1	60	1	0.6	0.6	0.6	0.6	60.6
50	2	2	2	2	62	2	0.8	1.6	1.6	1.6	62.2

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
51	316	1	1	1	1	353	1	72	1	1	64
52	632	-1	-1	-1	-1	863	4	32	4	-4	60
53	514	-1	-1	-1	1	900	4	5	8	8	68
54	480	1	1	1	1	769	3	82	3	3	71
55	817	-1	-1	-1	-1	648	2	58	2	-2	69
56	264	1	1	1	1	45	1	97	1	1	70
57	164	1	1	1	1	800	3	50	3	3	73
58	138	1	1	1	1	55	1	82	1	1	74
59	135	1	1	1	1	231	1	55	1	1	75
60	156	1	1	1	1	282	1	84	1	1	76
61	745	-1	-1	-1	-1	138	1	24	1	-1	75
62	752	-1	-1	-1	-1	52	1	3	2	-2	73
63	571	-1	-1	-1	-1	374	1	60	1	-1	72
64	212	1	1	1	1	768	3	24	3	3	75
65	360	1	1	1	1	255	1	50	1	1	76
66	689	-1	-1	-1	-1	249	1	93	1	-1	75
67	720	-1	-1	-1	-1	320	1	55	1	-1	74
68	816	-1	-1	-1	-1	556	2	96	2	-2	72
69	513	-1	-1	-1	1	993	4	40	4	4	76
70	230	1	1	1	1	174	1	56	1	1	77
71	708	-1	-1	-1	-1	883	4	61	4	-4	73
72	783	-1	-1	-1	-1	646	2	24	2	-2	71
73	807	-1	-1	-1	-1	583	2	75	2	-2	69
74	987	-1	-1	-1	-1	724	3	22	3	-3	66
75	547	-1	-1	-1	-1	37	1	16	1	-1	65

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
51	1	1	1	1	63	1	0.8	0.8	0.8	0.8	63.0
52	4	3	3	-3	60	4	0.8	3.2	3.2	-3.2	59.8
53	4	2	4	4	64	4	0.6	2.4	4.8	4.8	64.6
54	3	3	3	3	67	3	0.8	2.4	2.4	2.4	67.0
55	2	2	2	-2	65	2	0.8	1.6	1.6	-1.6	65.4
56	1	1	1	1	66	1	0.8	0.8	0.8	0.8	66.2
57	3	3	3	3	69	3	0.8	2.4	2.4	2.4	68.6
58	1	1	1	1	70	1	0.8	0.8	0.8	0.8	69.4
59	1	1	1	1	71	1	0.8	0.8	0.8	0.8	70.2
60	1	1	1	1	72	1	0.8	0.8	0.8	0.8	71.0
61	1	1	1	-1	71	1	0.8	0.8	0.8	-0.8	70.2
62	1	1	2	-2	69	1	0.8	0.8	1.6	-1.6	68.6
63	1	1	1	-1	68	1	0.8	0.8	0.8	-0.8	67.8
64	3	3	3	3	71	3	0.8	2.4	2.4	2.4	70.2
65	1	1	1	1	72	1	0.8	0.8	0.8	0.8	71.0
66	1	1	1	-1	71	1	0.8	0.8	0.8	-0.8	70.2
67	1	1	1	-1	70	1	0.8	0.8	0.8	-0.8	69.4
68	2	2	2	-2	68	2	0.8	1.6	1.6	-1.6	67.8
69	4	3	3	3	71	4	0.8	3.2	3.2	3.2	71.0
70	1	1	1	1	72	1	0.8	0.8	0.8	0.8	71.8
71	4	3	3	-3	69	4	0.8	3.2	3.2	-3.2	68.6
72	2	2	2	-2	67	2	0.8	1.6	1.6	-1.6	67.0
73	2	2	2	-2	65	2	0.8	1.6	1.6	-1.6	65.4
74	3	3	3	-3	62	3	0.8	2.4	2.4	-2.4	63.0
75	1	1	1	-1	61	1	0.8	0.8	0.8	-0.8	62.2

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
76	501	1	1	1	1	395	1	21	1	1	66
77	551	-1	-1	-1	-1	660	2	48	2	-2	64
78	322	1	1	1	1	406	1	83	1	1	65
79	163	1	1	1	1	893	4	1	8	8	73
80	990	-1	-1	-1	-1	832	4	2	8	-8	65
81	795	-1	-1	-1	-1	270	1	22	1	-1	64
82	114	1	1	1	1	149	1	40	1	1	65
83	260	1	1	1	1	527	2	70	2	2	67
84	640	-1	-1	-1	-1	867	4	46	4	-4	63
85	672	-1	-1	-1	-1	839	4	1	8	-8	55
86	921	-1	-1	-1	-1	261	1	16	1	-1	54
87	733	-1	-1	-1	-1	657	2	57	2	-2	52
88	822	-1	-1	-1	-1	289	1	3	2	-2	50
89	103	1	1	1	1	418	1	17	1	1	51
90	479	1	1	1	1	686	3	59	3	3	54
91	6	1	1	1	1	657	2	51	2	2	56
92	757	-1	-1	-1	-1	787	3	44	3	-3	53
93	135	1	1	1	1	550	2	99	2	2	55
94	622	-1	-1	-1	-1	339	1	1	2	-2	53
95	206	1	1	1	1	359	1	74	1	1	54
96	687	-1	-1	-1	-1	123	1	64	1	-1	53
97	478	1	1	1	1	239	1	40	1	1	54
98	406	1	1	1	1	812	3	8	6	6	60
99	236	1	1	1	1	971	4	6	8	8	68
100	725	-1	-1	-1	-1	433	2	61	2	-2	66

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
76	1	1	1	1	62	1	0.8	0.8	0.8	0.8	63.0
77	2	2	2	-2	60	2	0.8	1.6	1.6	-1.6	61.4
78	1	1	1	1	61	1	0.8	0.8	0.8	0.8	62.2
79	4	3	6	6	67	4	0.8	3.2	6.4	6.4	68.6
80	4	3	6	-6	61	4	0.8	3.2	6.4	-6.4	62.2
81	1	1	1	-1	60	1	0.8	0.8	0.8	-0.8	61.4
82	1	1	1	1	61	1	0.8	0.8	0.8	0.8	62.2
83	2	2	2	2	63	2	0.8	1.6	1.6	1.6	63.8
84	4	3	3	-3	60	4	0.8	3.2	3.2	-3.2	60.6
85	4	2	4	-4	56	4	0.8	3.2	6.4	-6.4	54.2
86	1	1	1	-1	55	1	0.6	0.6	0.6	-0.6	53.6
87	2	2	2	-2	53	2	0.6	1.2	1.2	-1.2	52.4
88	1	1	2	-2	51	1	0.6	0.6	1.2	-1.2	51.2
89	1	1	1	1	52	1	0.6	0.6	0.6	0.6	51.8
90	3	2	2	2	54	3	0.6	1.8	1.8	1.8	53.6
91	2	2	2	2	56	2	0.6	1.2	1.2	1.2	54.8
92	3	2	2	-2	54	3	0.6	1.8	1.8	-1.8	53.0
93	2	2	2	2	56	2	0.6	1.2	1.2	1.2	54.2
94	1	1	2	-2	54	1	0.6	0.6	1.2	-1.2	53.0
95	1	1	1	1	55	1	0.6	0.6	0.6	0.6	53.6
96	1	1	1	-1	54	1	0.6	0.6	0.6	-0.6	53.0
97	1	1	1	1	55	1	0.6	0.6	0.6	0.6	53.6
98	3	2	4	4	59	3	0.6	1.8	3.6	3.6	57.2
99	4	2	4	4	63	4	0.6	2.4	4.8	4.8	62.0
100	2	2	2	-2	61	2	0.8	1.6	1.6	-1.6	60.4

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
101	189	1	1	1	1	763	3	61	3	3	69
102	951	-1	-1	-1	-1	831	4	7	8	-8	61
103	128	1	1	1	1	210	1	48	1	1	62
104	416	1	1	1	1	759	3	76	3	3	65
105	356	1	1	1	1	278	1	32	1	1	66
106	499	1	1	1	1	523	2	47	2	2	68
107	540	-1	-1	-1	-1	120	1	95	1	-1	67
108	920	-1	-1	-1	-1	538	2	37	2	-2	65
109	641	-1	-1	-1	-1	783	3	62	3	-3	62
110	695	-1	-1	-1	-1	947	4	64	4	-4	58
111	177	1	1	1	1	298	1	78	1	1	59
112	163	1	1	1	1	391	1	36	1	1	60
113	61	1	1	1	1	516	2	37	2	2	62
114	561	-1	-1	-1	-1	80	1	11	2	-2	60
115	478	1	1	1	1	430	1	95	1	1	61
116	689	-1	-1	-1	-1	341	1	29	1	-1	60
117	347	1	1	1	1	898	4	5	8	8	68
118	810	-1	-1	-1	-1	937	4	15	4	-4	64
119	467	1	1	1	1	892	4	76	4	4	68
120	388	1	1	1	1	579	2	64	2	2	70
121	461	1	1	1	1	360	1	88	1	1	71
122	499	1	1	1	1	262	1	28	1	1	72
123	821	-1	-1	-1	-1	950	4	50	4	-4	68
124	13	1	1	1	1	680	3	66	3	3	71
125	128	1	1	1	1	779	3	99	3	3	74

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
101	3	3	3	3	64	3	0.8	2.4	2.4	2.4	62.8
102	4	3	6	-6	58	4	0.8	3.2	6.4	-6.4	56.4
103	1	1	1	1	59	1	0.6	0.6	0.6	0.6	57.0
104	3	2	2	2	61	3	0.6	1.8	1.8	1.8	58.8
105	1	1	1	1	62	1	0.6	0.6	0.6	0.6	59.4
106	2	2	2	2	64	2	0.6	1.2	1.2	1.2	60.6
107	1	1	1	-1	63	1	0.8	0.8	0.8	-0.8	59.8
108	2	2	2	-2	61	2	0.6	1.2	1.2	-1.2	58.6
109	3	3	3	-3	58	3	0.6	1.8	1.8	-1.8	56.8
110	4	2	2	-2	56	4	0.6	2.4	2.4	-2.4	54.4
111	1	1	1	1	57	1	0.6	0.6	0.6	0.6	55.0
112	1	1	1	1	58	1	0.6	0.6	0.6	0.6	55.6
113	2	2	2	2	60	2	0.6	1.2	1.2	1.2	56.8
114	1	1	2	-2	58	1	0.6	0.6	1.2	-1.2	55.6
115	1	1	1	1	59	1	0.6	0.6	0.6	0.6	56.2
116	1	1	1	-1	58	1	0.6	0.6	0.6	-0.6	55.6
117	4	2	4	4	62	4	0.6	2.4	4.8	4.8	60.4
118	4	3	3	-3	59	4	0.8	3.2	3.2	-3.2	57.2
119	4	2	2	2	61	4	0.6	2.4	2.4	2.4	59.6
120	2	2	2	2	63	2	0.6	1.2	1.2	1.2	60.8
121	1	1	1	1	64	1	0.8	0.8	0.8	0.8	61.6
122	1	1	1	1	65	1	0.8	0.8	0.8	0.8	62.4
123	4	3	3	-3	62	4	0.8	3.2	3.2	-3.2	59.2
124	3	3	3	3	65	3	0.6	1.8	1.8	1.8	61.0
125	3	3	3	3	68	3	0.8	2.4	2.4	2.4	63.4

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
126	758	-1	-1	-1	-1	987	4	10	8	-8	66
127	625	-1	-1	-1	-1	920	4	99	4	-4	62
128	207	1	1	1	1	181	1	17	1	1	63
129	499	1	1	1	1	96	1	40	1	1	64
130	338	1	1	1	1	865	4	66	4	4	68
131	132	1	1	1	1	305	1	4	2	2	70
132	92	1	1	1	1	222	1	54	1	1	71
133	564	-1	-1	-1	-1	79	1	87	1	-1	70
134	371	1	1	1	1	254	1	1	2	2	72
135	815	-1	-1	-1	-1	32	1	76	1	-1	71
136	95	1	1	1	1	522	2	18	2	2	73
137	666	-1	-1	-1	-1	217	1	45	1	-1	72
138	884	-1	-1	-1	-1	801	3	6	6	-6	66
139	913	-1	-1	-1	-1	687	3	95	3	-3	63
140	219	1	1	1	1	394	1	80	1	1	64
141	775	-1	-1	-1	-1	21	1	99	1	-1	63
142	715	-1	-1	-1	-1	31	1	36	1	-1	62
143	765	-1	-1	-1	-1	946	4	10	8	-8	54
144	799	-1	-1	-1	-1	791	3	22	3	-3	51
145	750	-1	-1	-1	-1	299	1	74	1	-1	50
146	956	-1	-1	-1	-1	18	1	73	1	-1	49
147	977	-1	-1	-1	-1	394	1	70	1	-1	48
148	665	-1	-1	-1	-1	157	1	58	1	-1	47
149	274	1	1	1	1	904	4	45	4	4	51
150	744	-1	-1	-1	-1	439	2	53	2	-2	49

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
126	4	3	6	-6	62	4	0.8	3.2	6.4	-6.4	57.0
127	4	3	3	-3	59	4	0.6	2.4	2.4	-2.4	54.6
128	1	1	1	1	60	1	0.6	0.6	0.6	0.6	55.2
129	1	1	1	1	61	1	0.6	0.6	0.6	0.6	55.8
130	4	3	3	3	64	4	0.6	2.4	2.4	2.4	58.2
131	1	1	2	2	66	1	0.6	0.6	1.2	1.2	59.4
132	1	1	1	1	67	1	0.6	0.6	0.6	0.6	60.0
133	1	1	1	-1	66	1	0.6	0.6	0.6	-0.6	59.4
134	1	1	2	2	68	1	0.6	0.6	1.2	1.2	60.6
135	1	1	1	-1	67	1	0.8	0.8	0.8	-0.8	59.8
136	2	2	2	2	69	2	0.6	1.2	1.2	1.2	61.0
137	1	1	1	-1	68	1	0.8	0.8	0.8	-0.8	60.2
138	3	3	6	-6	62	3	0.8	2.4	4.8	-4.8	55.4
139	3	3	3	-3	59	3	0.6	1.8	1.8	-1.8	53.6
140	1	1	1	1	60	1	0.6	0.6	0.6	0.6	54.2
141	1	1	1	-1	59	1	0.6	0.6	0.6	-0.6	53.6
142	1	1	1	-1	58	1	0.6	0.6	0.6	-0.6	53.0
143	4	2	4	-4	54	4	0.6	2.4	4.8	-4.8	48.2
144	3	2	2	-2	52	3	0.6	1.8	1.8	-1.8	46.4
145	1	1	1	-1	51	1	0.6	0.6	0.6	-0.6	45.8
146	1	1	1	-1	50	1	0.6	0.6	0.6	-0.6	45.2
147	1	1	1	-1	49	1	0.6	0.6	0.6	-0.6	44.6
148	1	1	1	-1	48	1	0.6	0.6	0.6	-0.6	44.0
149	4	2	2	2	50	4	0.6	2.4	2.4	2.4	46.4
150	2	2	2	-2	48	2	0.6	1.2	1.2	-1.2	45.2

Risk of Ruin Blackjack Simulation
80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
151	425	1	1	1	1	621	2	47	2	2	51
152	826	-1	-1	-1	-1	840	4	85	4	-4	47
153	436	1	1	1	1	270	1	23	1	1	48
154	262	1	1	1	1	657	2	98	2	2	50
155	660	-1	-1	-1	-1	13	1	96	1	-1	49
156	944	-1	-1	-1	-1	665	2	57	2	-2	47
157	819	-1	-1	-1	-1	828	4	49	4	-4	43
158	512	-1	-1	-1	1	597	2	50	2	-2	41
159	338	1	1	1	1	138	1	45	1	1	42
160	405	1	1	1	1	794	3	48	3	3	45
161	544	-1	-1	-1	-1	525	2	63	2	-2	43
162	354	1	1	1	1	595	2	85	2	2	45
163	872	-1	-1	-1	-1	924	4	76	4	-4	41
164	497	1	1	1	1	386	1	25	1	1	42
165	394	1	1	1	1	499	2	36	2	2	44
166	454	1	1	1	1	73	1	58	1	1	45
167	682	-1	-1	-1	-1	588	2	66	2	-2	43
168	578	-1	-1	-1	-1	174	1	35	1	-1	42
169	182	1	1	1	1	691	3	48	3	3	45
170	365	1	1	1	1	626	2	47	2	2	47
171	577	-1	-1	-1	-1	373	1	44	1	-1	46
172	134	1	1	1	1	149	1	32	1	1	47
173	157	1	1	1	1	512	2	10	4	4	51
174	461	1	1	1	1	623	2	70	2	2	53
175	870	-1	-1	-1	-1	523	2	85	2	-2	51

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
151	2	2	2	2	50	2	0.6	1.2	1.2	1.2	46.4
152	4	2	2	-2	48	4	0.6	2.4	2.4	-2.4	44.0
153	1	1	1	1	49	1	0.6	0.6	0.6	0.6	44.6
154	2	2	2	2	51	2	0.6	1.2	1.2	1.2	45.8
155	1	1	1	-1	50	1	0.6	0.6	0.6	-0.6	45.2
156	2	2	2	-2	48	2	0.6	1.2	1.2	-1.2	44.0
157	4	2	2	-2	46	4	0.6	2.4	2.4	-2.4	41.6
158	2	2	2	-2	44	2	0.6	1.2	1.2	-1.2	40.4
159	1	1	1	1	45	1	0.6	0.6	0.6	0.6	41.0
160	3	2	2	2	47	3	0.6	1.8	1.8	1.8	42.8
161	2	2	2	-2	45	2	0.6	1.2	1.2	-1.2	41.6
162	2	2	2	2	47	2	0.6	1.2	1.2	1.2	42.8
163	4	2	2	-2	45	4	0.6	2.4	2.4	-2.4	40.4
164	1	1	1	1	46	1	0.6	0.6	0.6	0.6	41.0
165	2	2	2	2	48	2	0.6	1.2	1.2	1.2	42.2
166	1	1	1	1	49	1	0.6	0.6	0.6	0.6	42.8
167	2	2	2	-2	47	2	0.6	1.2	1.2	-1.2	41.6
168	1	1	1	-1	46	1	0.6	0.6	0.6	-0.6	41.0
169	3	2	2	2	48	3	0.6	1.8	1.8	1.8	42.8
170	2	2	2	2	50	2	0.6	1.2	1.2	1.2	44.0
171	1	1	1	-1	49	1	0.6	0.6	0.6	-0.6	43.4
172	1	1	1	1	50	1	0.6	0.6	0.6	0.6	44.0
173	2	2	4	4	54	2	0.6	1.2	2.4	2.4	46.4
174	2	2	2	2	56	2	0.6	1.2	1.2	1.2	47.6
175	2	2	2	-2	54	2	0.6	1.2	1.2	-1.2	46.4

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

Hand #	(1) Randbetween (1,1000)	(2a) a = 0.66% If ((1)<=503,1,-1)	(2b) a = 1.21% If ((1)<=506,1,-1)	(2c) a = 1.90% If ((1)<=509,1,-1)	(2d) a = 3.66% If ((1)<=518,1,-1)	(4) Randbetween (1,1000)	(5) Initial Bet	(6) Randbetween (1,100)	(7) Final Bet: if (6) <= 12 Double	(8) Amount Won = (7)*(2x)	(9) Bankroll (B) = B:prev + (8)
176	288	1	1	1	1	748	3	14	3	3	54
177	135	1	1	1	1	612	2	67	2	2	56
178	837	-1	-1	-1	-1	75	1	76	1	-1	55
179	759	-1	-1	-1	-1	712	3	95	3	-3	52
180	990	-1	-1	-1	-1	137	1	7	2	-2	50
181	847	-1	-1	-1	-1	246	1	14	1	-1	49
182	923	-1	-1	-1	-1	670	2	1	4	-4	45
183	747	-1	-1	-1	-1	296	1	5	2	-2	43
184	518	-1	-1	-1	1	31	1	61	1	-1	42
185	574	-1	-1	-1	-1	252	1	6	2	-2	40
186	618	-1	-1	-1	-1	290	1	10	2	-2	38
187	453	1	1	1	1	120	1	14	1	1	39
188	516	-1	-1	-1	1	654	2	60	2	-2	37
189	953	-1	-1	-1	-1	190	1	57	1	-1	36
190	542	-1	-1	-1	-1	231	1	83	1	-1	35
191	535	-1	-1	-1	-1	196	1	16	1	-1	34
192	277	1	1	1	1	310	1	28	1	1	35
193	448	1	1	1	1	264	1	61	1	1	36
194	265	1	1	1	1	567	2	9	4	4	40
195	184	1	1	1	1	227	1	2	2	2	42
196	331	1	1	1	1	896	4	12	8	8	50
197	327	1	1	1	1	574	2	40	2	2	52
198	218	1	1	1	1	420	1	40	1	1	53
199	210	1	1	1	1	786	3	68	3	3	56
200	327	1	1	1	1	239	1	9	2	2	58

Unmodified Bet Spread, Risk of Ruin		**Modified Bet Spread, Risk of Ruin**		**minimum**	**34**
Number of Simulated Trips	100,000	Number of Simulated Trips	100,000	**if min <= 0 then ruin**	
Number of Bankruptcies	2,237	Number of Bankruptcies	352		
Risk of Ruin	**2.24%**	Risk of Ruin	**0.35%**		

Note: Risk of Ruin is slightly underestimated. This is because the number of units bet was not restricted by the current bankroll but taken as the indicated final units bet. Units Bet should = min(indicated final units bet, max(0, current bankroll)). So if current bankroll = 2 and indicated final bet = 4, units bet should = 2, but was taken as 4. So if hand was lost then current bank should = 0 but bank recorded as - 2 here. In either case, min(bank) <= 0 and so trip was recorded as ruin. But if hand was won, the bank was recorded as 6 when it should have been 4. A 6 unit bankroll has a smaller Risk of Ruin than a 4 units bankroll. Thus RoR is *slightly* underestimated. By not

Risk of Ruin Blackjack Simulation

80 unit bankroll, 200 hands played

	Method 1: Unit Bet Size Constant, Betting Schedules S4, S3 and S2					Method 2: Betting Schedule S4 with Modified Unit Bet Size					
	(10) = (5)	(11)	(12)	(13)	(14)	(15) = (5)	(16)	(17)	(18)	(19)	(20)
Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)	Initial Bet	Modified Unit Bet Size	Modified Initial Bet = (15)*(16)	Modified Final Bet: Double if (7) > (5)	Amount Won = (17)*SIGN(8)	Bankroll (B) = B:prev + (12)
176	3	2	2	2	56	3	0.6	1.8	1.8	1.8	48.2
177	2	2	2	2	58	2	0.6	1.2	1.2	1.2	49.4
178	1	1	1	-1	57	1	0.6	0.6	0.6	-0.6	48.8
179	3	2	2	-2	55	3	0.6	1.8	1.8	-1.8	47.0
180	1	1	2	-2	53	1	0.6	0.6	1.2	-1.2	45.8
181	1	1	1	-1	52	1	0.6	0.6	0.6	-0.6	45.2
182	2	2	4	-4	48	2	0.6	1.2	2.4	-2.4	42.8
183	1	1	2	-2	46	1	0.6	0.6	1.2	-1.2	41.6
184	1	1	1	-1	45	1	0.6	0.6	0.6	-0.6	41.0
185	1	1	2	-2	43	1	0.6	0.6	1.2	-1.2	39.8
186	1	1	2	-2	41	1	0.6	0.6	1.2	-1.2	38.6
187	1	1	1	1	42	1	0.6	0.6	0.6	0.6	39.2
188	2	2	2	-2	40	2	0.6	1.2	1.2	-1.2	38.0
189	1	1	1	-1	39	1	0.6	0.6	0.6	-0.6	37.4
190	1	1	1	-1	38	1	0.6	0.6	0.6	-0.6	36.8
191	1	1	1	-1	37	1	0.6	0.6	0.6	-0.6	36.2
192	1	1	1	1	38	1	0.6	0.6	0.6	0.6	36.8
193	1	1	1	1	39	1	0.6	0.6	0.6	0.6	37.4
194	2	2	4	4	43	2	0.6	1.2	2.4	2.4	39.8
195	1	1	2	2	45	1	0.6	0.6	1.2	1.2	41.0
196	4	2	4	4	49	4	0.6	2.4	4.8	4.8	45.8
197	2	2	2	2	51	2	0.6	1.2	1.2	1.2	47.0
198	1	1	1	1	52	1	0.6	0.6	0.6	0.6	47.6
199	3	2	2	2	54	3	0.6	1.8	1.8	1.8	49.4
200	1	1	2	2	56	1	0.6	0.6	1.2	1.2	50.6

Modified Unit Bet Size. Risk of Ruin		**minimum**	**37**	**minimum** **36.2**
Number of Simulated Trips	100,000	**if min <= 0 then ruin**		**if min <= 0 then ruin**
Number of Bankruptcies	84			
Risk of Ruin	**0.08%**			

Bankruptcy: Initial 80 unit bankroll is lost at sometime during trip if minimum of bankroll columns (9), (14) or (20) is less than or equal to zero.

placing the current bankroll restriction on bets and saving the final bankroll for each trip, RoR can be calculated for various bankrolls with the calculated RoR slightly underestimated: Risk of Ruin for an initial bankroll of Bi* = (Bi - x) is p(x) = (# trips where min(bankroll) <= x) / (# simulated trips). (See next Exhibit for examples).

100,000 day trip simulation, unmodified betting: (1) number of final units bet not restricted by current bankroll, min(bank) <= 0 taken as ruin (2) final units bet capped at current bankroll

Calculations (1) and (2) were done on the same 100,000 day trip simulation. Ruin occurred 2,184 under (1) and 2,292 times under (2): (1) underestimated RoR by (108/100,000)≈ 0.1%.

Risk of Ruin Blackjack Simulation

Initial Bankroll is 80 units. Summing up all occurrences when minimum(bankroll) <= "x" and dividing by number of simulations gives the probability that the bankroll is less than or equal to "x" at some point during the trip. If x = 0, then this probability is the probability of bankruptcy of the initial 80 unit initial bankroll. If x = 20, for example, then this is the probability that the initial 80 unit bankroll will be less than or equal to 20 at some point during the trip which is equivalent to losing 60 or more units of the 80 unit bankroll at some point during the trip which is equivalent to bankruptcy of an initial 60 units bankroll. If x = -30, for example, this is equivalent to an initial 80 unit bankroll being less than -30 at some point during the trip with is the same as a initial 110 unit bankroll being less than or equal to zero at some point during the trip, i.e. the probability of bankruptcy of an initial 110 unit bankroll.

Save minimum bankrolls, i.e. save minimum of column (9) for unmodified bet spread and save minimum of columns (14) and (20) for modified betting, for each simulated trip.
If Bi = initial bankroll and p(x) = probability that "x" or less units are left out of the initial Bi unit bankroll at some point during the trip
then the risk of ruin for an initial bankroll of Bi* = (Bi - x) is p(x) = (# trips where min(bankroll) <= x) / (# simulated trips).
If Bi = 80 and x = 20 then Bi* = (80 - 20) = 60 and p(20) = (# trips where min(B) <= 20) / (# simulated trips)
If Bi = 80 and x = -30 then Bi* = (80 - (-30)) = 110 and p(-30) = (# trips where min(B) <= -30) / (# simulated trips)

Save ending bankrolls, i.e. save hand # 200, column (9) for unmodified bet spread and save hand # 200, columns (14) and (20) for modified betting, for each simulated trip.
If ruin, the ending bankroll is set to zero, i.e. if for a given trip, minimum(bankroll) <= 0, then ending bankroll for that trip is set to zero.

Simulated 100,000 Trips Results: Day Trip (8 hours, 200 hands played, initial bankroll = 80 units)

	Risk of Ruin (RoR)			Ending Bankroll						
Bet	# Trips	# bkrupt	RoR	# Trips	Average	Profit	SD Trip	SD Mean *	Profit + 2σ	Profit - 2σ
Unmodified Bet Spread	100,000	2,237	2.24%	100,000	89.46	9.46	38.81	0.12	9.71	9.22
Modified Bet Spread	100,000	352	0.35%	100,000	88.65	8.65	37.06	0.12	8.88	8.41
Modified Unit Bet Size	100,000	84	0.08%	100,000	88.50	8.50	36.18	0.11	8.73	8.27

*SD(Mean) = SD(Trip) / SQRT(# Trips), # trips = 100,000

Day Trip (8 hours, 200 hands played)

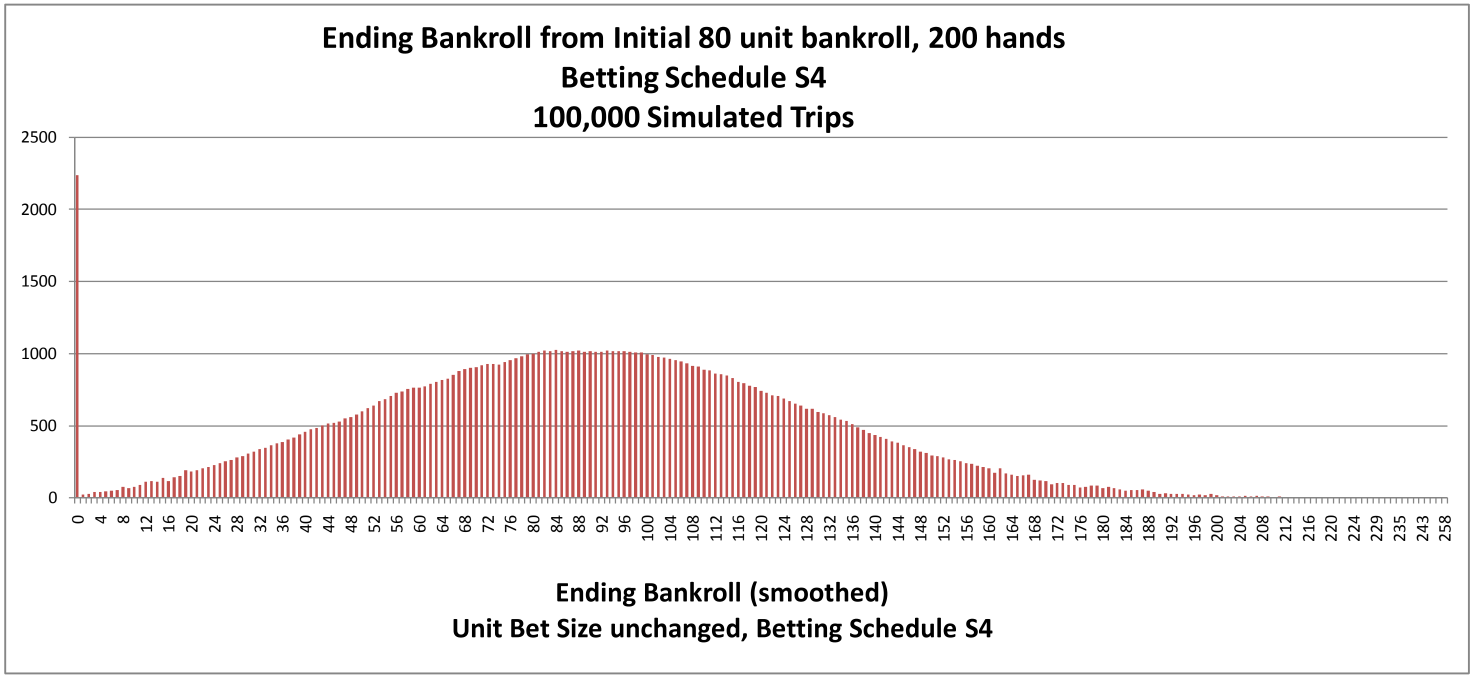
Unmodified Betting Expected Win and Standard Deviation: Simulation (100,000 trips) vs. Theory

	Theory	Simulation
Exp Win	9.60	9.46
Std Dev	39.03	38.81

μ(1)	expected one hour win	1.2
σ(1)	one hour standard deviation	13.8
μ(8)	= 8 * μ(1) =	9.6
σ(8)	= SQRT(8) * σ(1) =	39.0

	Prob of a losing trip			Minimum Bank during trip					
Bet	# Trips	Bank < 80	P(Loss)	# Trips	Average	SD Trip	SD Mean	μ + 2σ	μ - 2σ
Unmodified Bet Spread	100,000	39,833	39.8%	100,000	55.22	20.43	0.06	55.35	55.09
Modified Bet Spread	100,000	43,771	43.8%	100,000	57.52	17.04	0.05	57.63	57.41
Modified Unit Bet Size	100,000	45,351	45.4%	100,000	58.74	15.42	0.05	58.84	58.64

If X = amount won, P(Loss) = P(X < 0) = NORMDIST(0,μ,σ,TRUE) = Probability that player is behind categorized by hands back counted and betting schedule.
μ(1) = 1.2, σ(1) = 13.8, μ(n) = n*μ(1), and σ(n) = SQRT(n)*σ(1) where n = hours played. For a day trip, n = 8 hours (200 hands played),
so P(Loss) = NORMDIST(0,(1.2*8),(SQRT(8)*13.8),TRUE) = 40.2%. The probability of loss is measured at the end of the given number of hands played,
i.e. the bankroll is checked for a loss at the end of playing the given number of hands, not during the play of those hands.



Smoothed Ending Bankroll("k" units) = Average(ending bankroll(k-3, k-2, k-1, k, k+1, k+2, k+3)), 20 <= k <= 160

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

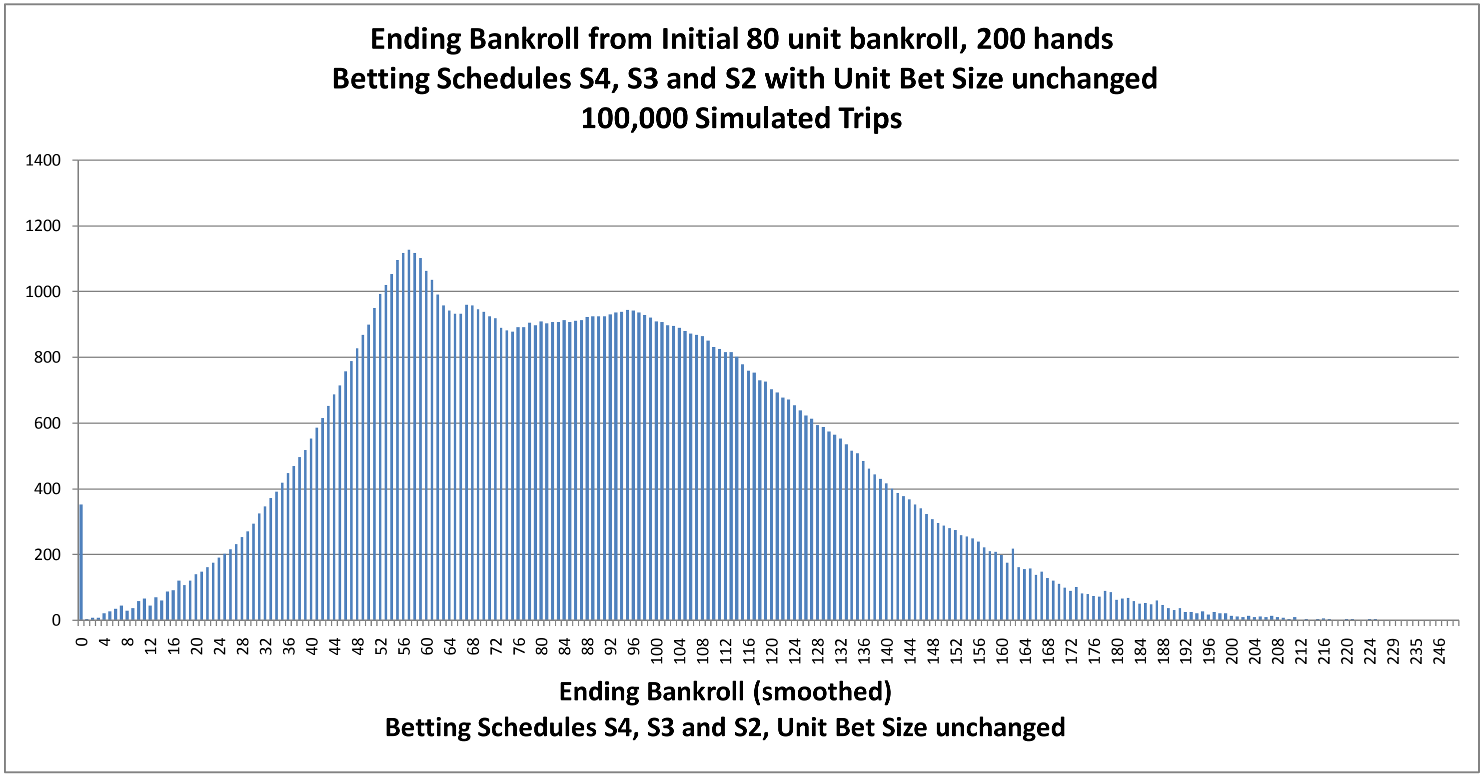
No changes in Unit Bet Size
No change in Betting Schedule S4

Initial Bank = 80 units
Expected Profit = Mean Ending Bank - Initial Bank
SD of Mean = SD Trip / SQRT(# trips), # trips = 100,000
RoR = Risk of Ruin
Prob (Losing Trip) = Prob (Ending Bankroll < Initial Bankroll)

Ending Bankroll

	Mean	Expected Profit	Mode	Median	Std Dev of Trip	Std Dev of Mean	Profit - 2σ(mean)	Prob of Losing Trip	RoR
Method #0: Unit Bet Size Unchanged, Betting Schedule S4	89.46	9.46	0	89	38.8	0.12	9.22	40%	2.2%
Method #1: Modified Betting Schedules: Betting Schedules S4, S3 and S2	88.65	8.65	58	86	37.1	0.12	8.41	44%	0.4%
Method #2: Modified Unit Bet Size, Betting Schedule S4	88.50	8.50	59	84	36.2	0.11	8.27	45%	0.1%
Method #3: Aggressive Modified Unit Bet Size, Betting Schedule S4	89.69	9.69	56 & 93	86	40.8	0.13	9.43	44%	0.5%
Method #4: Unit Bet Size = (Current Bank) / (Initial Bank), Betting Sch S4	89.96	9.96	62	80	46.3	0.15	9.67	50%	0.0%

Profit from Method #3, 9.69 units per day trip with initial 80 unit bankroll, exceeds the profit from Method #0, unmodified betting, 9.46 units, with a standard deviation of 40.8, slightly larger than Method #0, unmodified day trip's standard deviation of 38.8 units -- but Method #3's slightly larger standard deviation is mainly due Method #3 distribution's longer right tail and lower Risk of Ruin. Method #3's Risk of Ruin is only 0.5% as compared to 2.2% for Method #0. Methods #1 and #2 are more conservative than Method #3 and result in even lower Risks of Ruin and somewhat smaller standard deviations but at a cost of lower expected trip wins of 8.65 and 8.50 units respectively. Although Method #4 gives the highest expected profit with a zero percent risk of ruin, this method is not recommended. The high mean comes from the rare extreme large wins. Also Method #4 has the lowest median of 80 units and the largest trip standard deviation of 46.3 units. Finally Method #4 would require an instantaneous and exact calculation of (unit bet size) = (current bankroll) / (initial bankroll) * (initial unit bet size) each time a bet was to be placed.



Smoothed Ending Bankroll("k" units) = Average(ending bankroll(k-3, k-2, k-1, k, k+1, k+2, k+3)), 20 <= k <= 160

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4
S3	1	2	3	3
S2	1	2	2	2

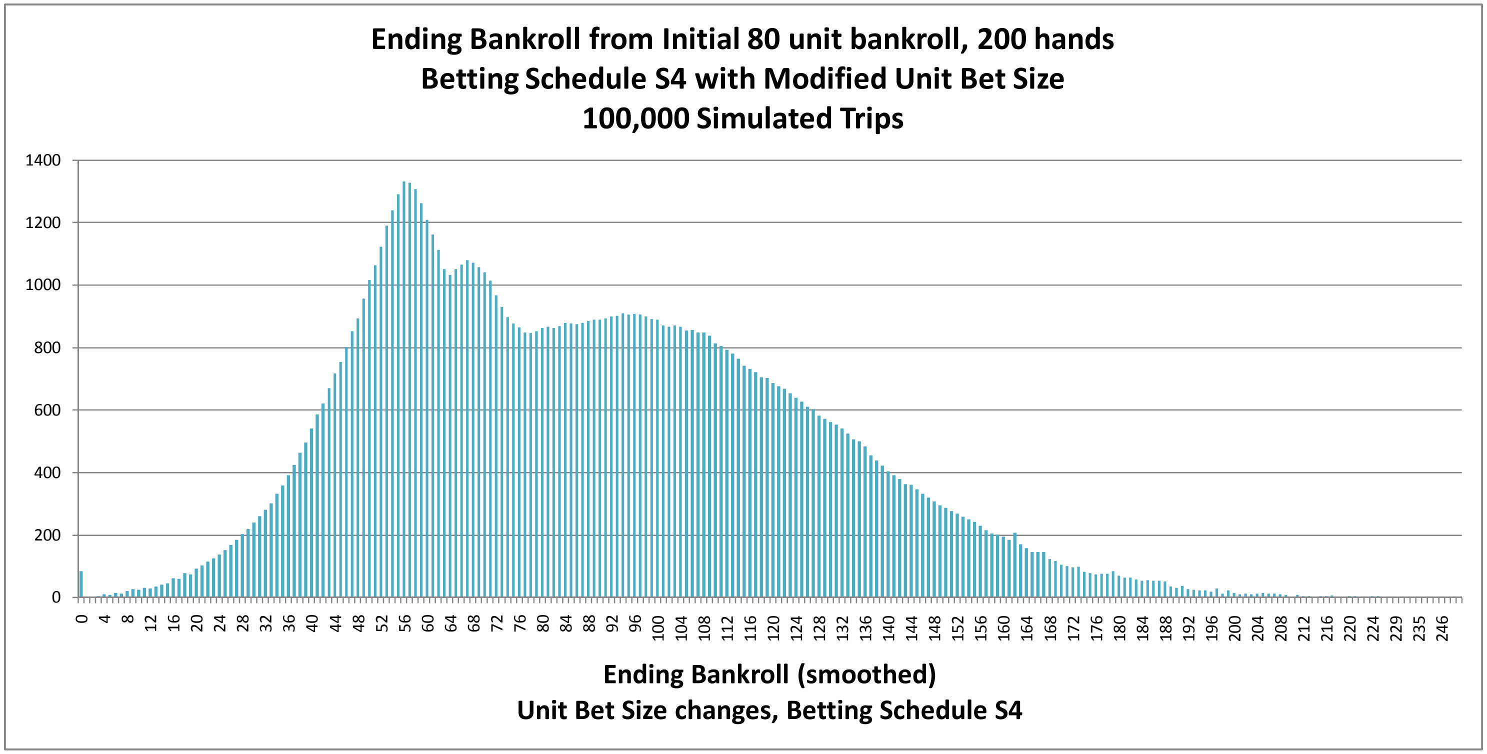
Betting Schedule S4:
(Current Bank) > 0.90*(Initial Bank)
(Current Bank) > 72 units

Betting Schedule S3:
0.75*(Initial Bank) < (Cur Bank) <= 0.90*(Initial Bank)
60 units < (Cur Bank) <= 72 units

Betting Schedule S2:
(Current Bank) <= 0.75*(Initial Bank)
(Current Bank) <= 60 units

Example #1: $25 day trip player. Bankroll = 80 units = $2,000			
Current Bank	$2,000	$1,800	$1,500
Betting Schedule	**S4**	S3	S2

Example #2: $15 day trip player. Bankroll = 80 units = $1,200			
Current Bank	$1,200	$1,080	$900
Betting Schedule	**S4**	S3	S2



Smoothed Ending Bankroll("k" units) = Average(ending bankroll(k-3, k-2, k-1, k, k+1, k+2, k+3)), 20 <= k <= 160

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

Unit Bet Size = Initial Unit Bet Size
Betting Schedule S4 unchanged
(Current Bank) > 0.90*(Initial Bank)
(Current Bank) > 72 units

Unit Bet Size = 0.80*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
0.75*(Initial Bank) < (Cur Bank) <= 0.90*(Initial Bank)
60 units < (Cur Bank) <= 72 units

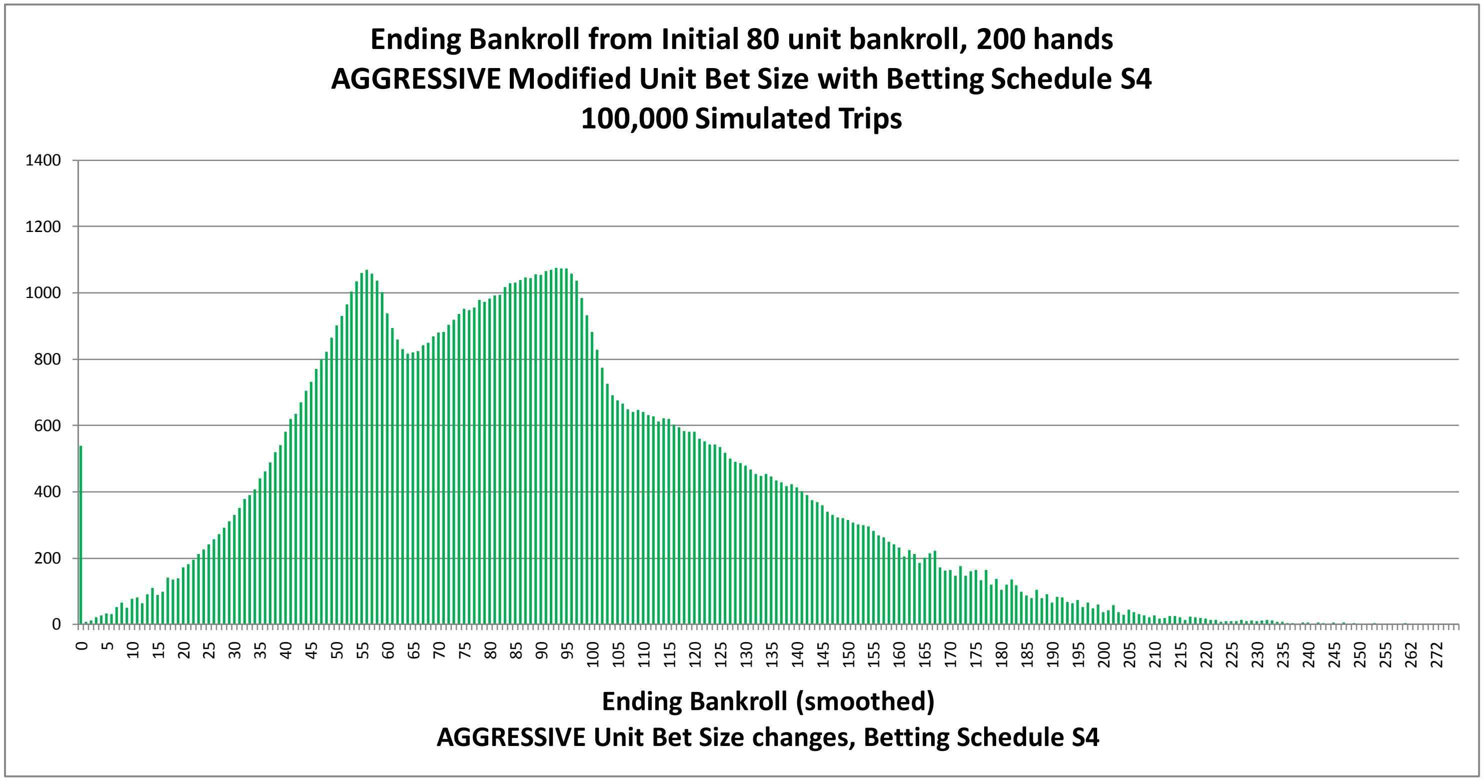
Unit Bet Size = 0.60*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
(Current Bank) <= 0.75*(Initial Bank)
(Current Bank) <= 60 units

Example #1: $25 day trip player. Bankroll = 80 units = $2,000

Current Bank	$2,000	$1,800	$1,500
Unit Bet Size	**$25**	$20	$15

Example #2: $15 day trip player. Bankroll = 80 units = $1,200

Current Bank	$1,200	$1,080	$900
Unit Bet Size	**$15**	$12	$10



Smoothed Ending Bankroll("k" units) = Average(ending bankroll(k-3, k-2, k-1, k, k+1, k+2, k+3)), 20 <= k <= 160

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

Unit Bet Size = 1.25*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
(Current Bank) > 1.25*(Initial Bank)
(Current Bank) > 100 units

Unit Bet Size = Initial Unit Bet Size
Betting Schedule S4 unchanged
0.75*(Initial Bank) < (Cur Bank) <= 1.25*(Initial Bank)
60 units < (Cur Bank) <= 100 units

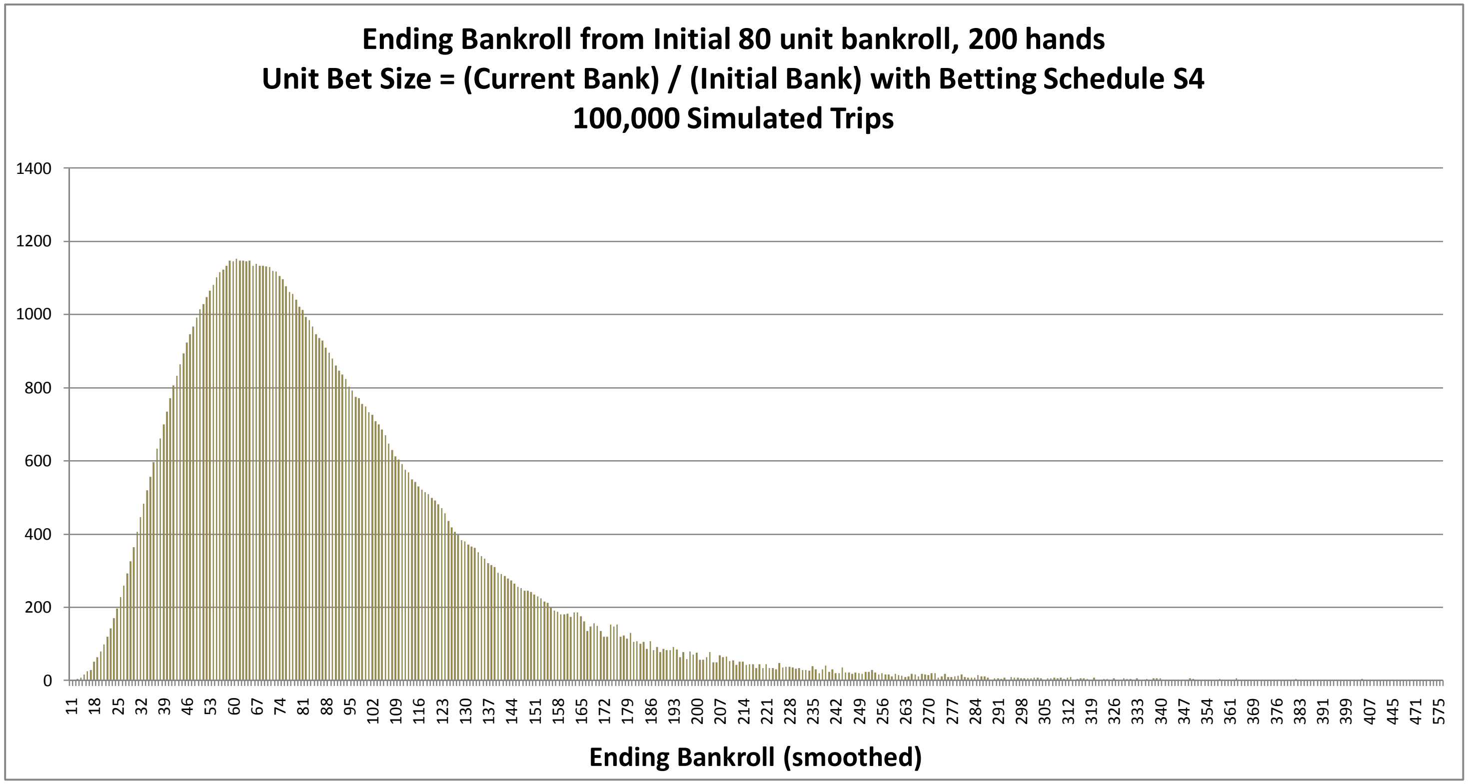
Unit Bet Size = 0.75*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
(Current Bank) <= 0.75*(Initial Bank)
(Current Bank) <= 60 units

Example #1: $25 day trip player. Bankroll = 80 units = $2,000

Current Bank	$2,500	$2,000	$1,500
Unit Bet Size (rounded)	$30	**$25**	$20

Example #2: $15 day trip player. Bankroll = 80 units = $1,200

Current Bank	$1,500	$1,200	$900
Unit Bet Size (rounded)	$20	**$15**	$10



Smoothed Ending Bankroll("k" units) = Average(ending bankroll(k-3, k-2, k-1, k, k+1, k+2, k+3)), 20 <= k <= 160

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

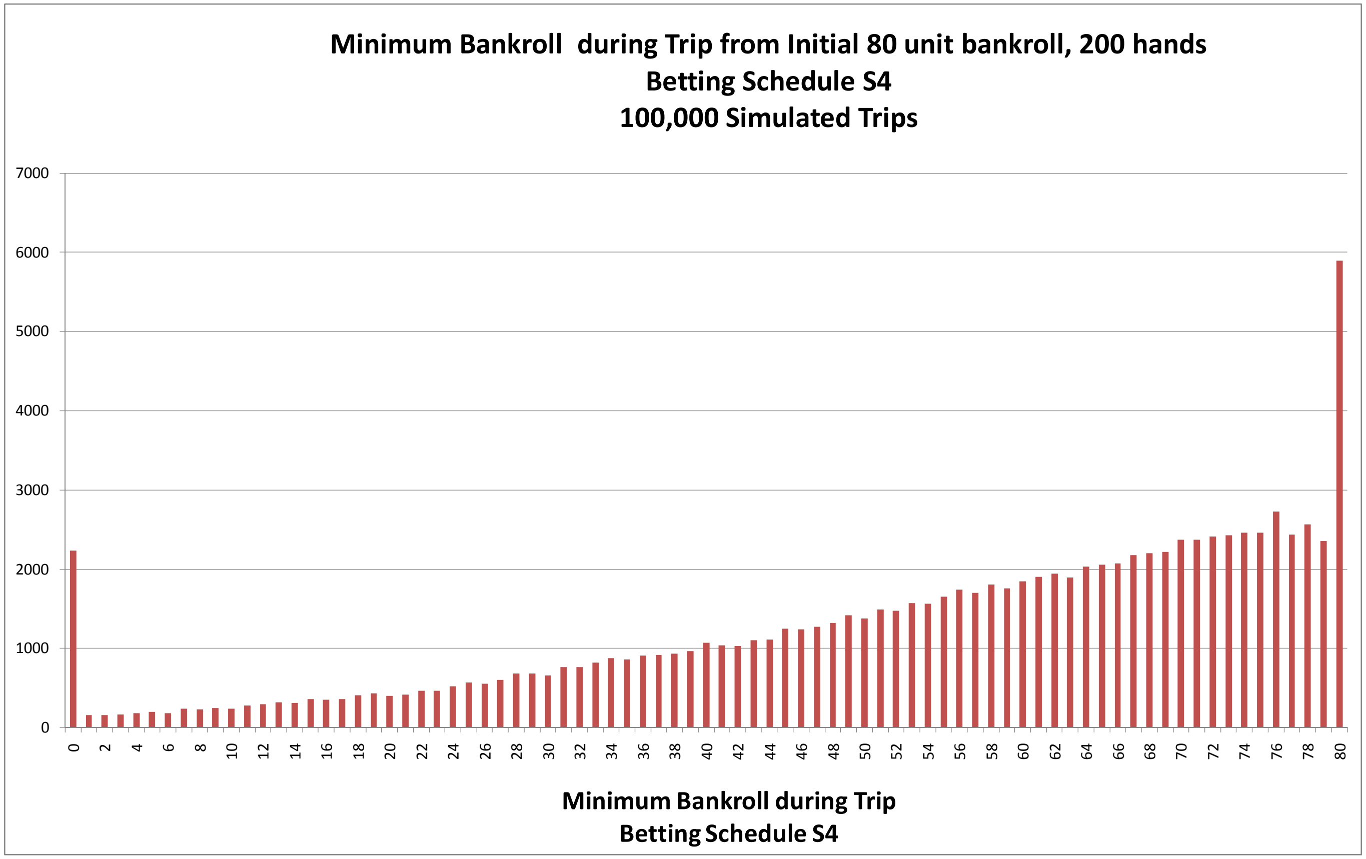
Unit Bet Size = ((Current Bank) / (Initial Bank)) * (Initial Unit Bet Size)
Betting Schedule S4 unchanged

Ending Trip Bankroll

	Mean	Std Dev	Skew	Kurtosis *	RoR
Method #0: Unit Bet Size Unchanged, Betting Schedule S4	89.46	38.8	0.02	-0.12	2.2%
Method #1: Modified Betting Schedules: Betting Schedules S4, S3 and S2	88.65	37.1	0.33	-0.27	0.4%
Method #2: Modified Unit Bet Size, Betting Schedule S4	88.50	36.2	0.46	-0.26	0.1%
Method #3: Aggressive Modified Unit Bet Size, Betting Schedule S4	89.69	40.8	0.55	0.16	0.5%
Method #4: Unit Bet Size = (Current Bank) / (Initial Bank), Betting Sch S4	89.96	46.3	1.65	4.98	0.0%

Statistics from truncated distribution:
(bankroll set to zero whenever minimum bankroll during trip <= 0)

* Excel function KURT(X) ≈ (E(X - μ)^4 / σ^4) - 3
Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.



Mean	54.942	Std Dev	21.330	Skew	-1.148	Kurtosis *	1.316	Statistics from full distribution (negative bankrolls included)
Mean	55.222	Std Dev	20.431	Skew	-0.896	Kurtosis *	0.093	Statistics from truncated distribution: (minimum and ending bankrolls set to zero whenever minimum bankroll during trip <= 0)

* Excel function KURT(X) ≈ (E(X - μ)^4 / σ^4) - 3

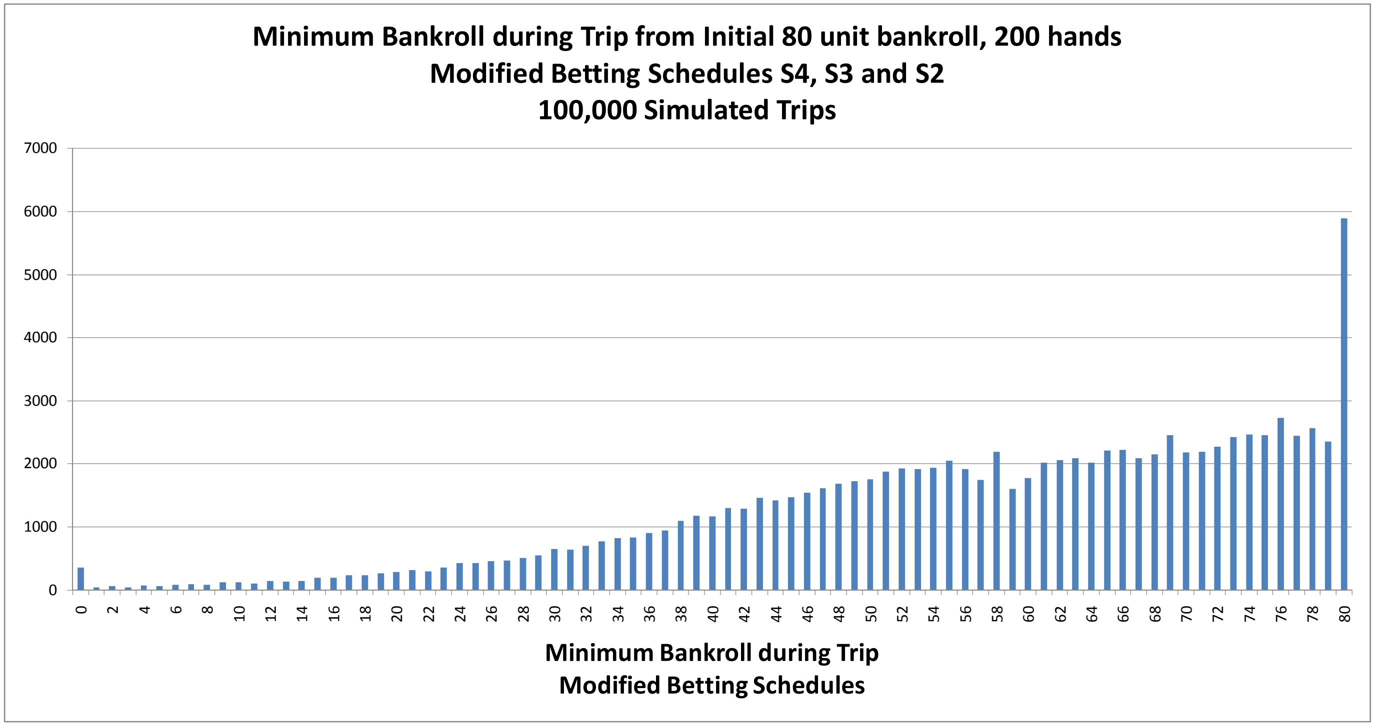
Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

Maximum Drawdown during Trip = Initial Bankroll - Minimum Bankroll during Trip

Risk of Ruin = Percentage of Trips where Minimum Bankroll during Trip <= 0



Mean	57.495	Std Dev	17.134	Skew	-0.781	Kurtosis *	0.329	Statistics from full distribution (negative bankrolls included)
Mean	57.521	Std Dev	17.040	Skew	-0.735	Kurtosis *	0.082	Statistics from truncated distribution: (minimum and ending bankrolls set to zero whenever minimum bankroll during trip <= 0)

* Excel function KURT(X) ≈ (E(X - μ)^4 / σ^4) - 3

Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4
S3	1	2	3	3
S2	1	2	2	2

If (Current Bank) > 0.90*(Initial Bank) = 72 units, then Betting Schedule S4
If 0.75*(Initial Bank) < (Current Bank) <= 0.90*(Initial Bank), i.e. 60 units < (Current Bank) <= 72 units., then Bettin
If (Current Bank) <= 0.75*(Initial Bank) = 60 units, then Betting Schedule S2

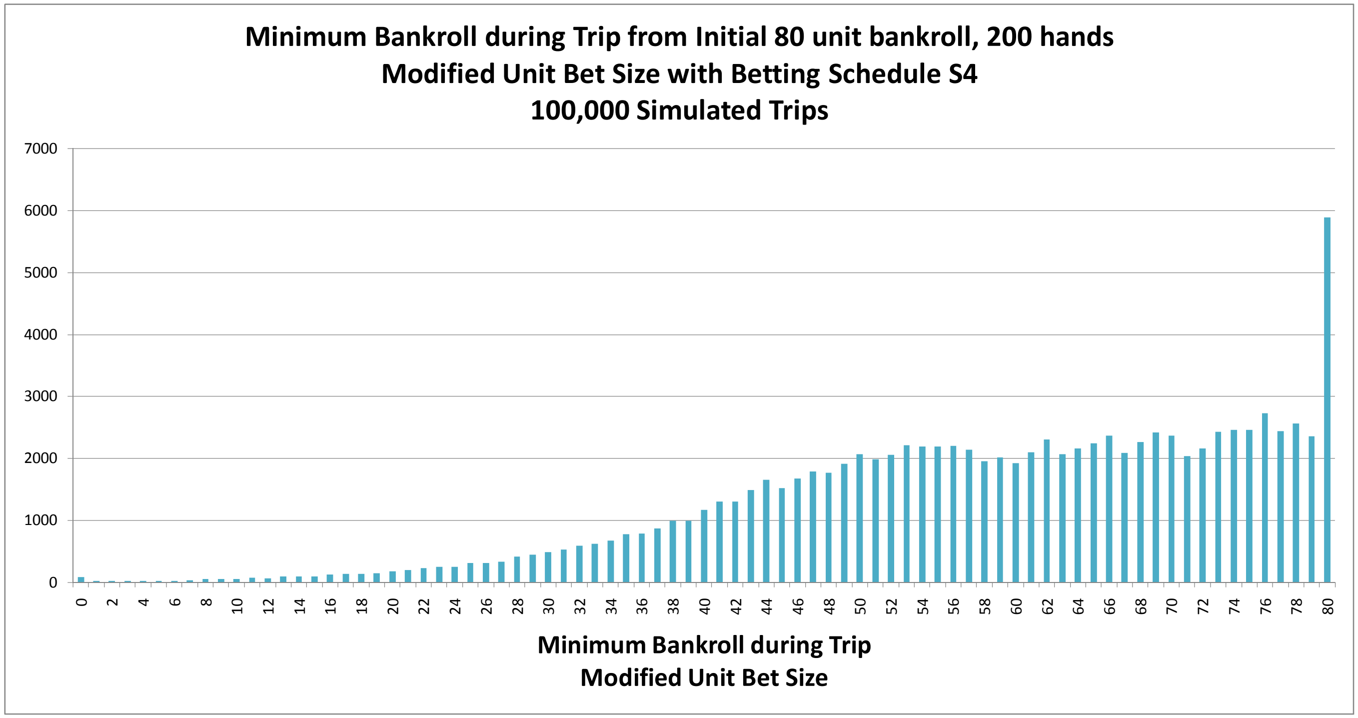
Minimum Bankroll During Trip

	Mean	Std Dev	Skew	ABS(Skew)	Kurtosis
Unmodified Betting	55.22	20.4	-0.90	0.90	0.09
Modified Betting Sch	57.52	17.0	-0.74	0.74	0.08

Statistics from truncated distribution: (bankroll set to zero whenever minimum bankroll during trip <= 0)

Maximum Drawdown = Initial Bankroll - Minimum Bankroll during Trip
Initial Bankroll = 80 units
Maximum Drawdown = 80 units - Minimum Bankroll during Trip

(1) Modified Betting has a higher average minimum bankroll during the trip than Unmodified Betting (average maximum drawdown of modified betting is less).
(2) Modified Betting has a smaller standard deviation than unmodified betting, so less variability of the maximum drawdown from the mean drawdown.
(3) Both distributions are skewed to the left of the mean but modified betting is skewed less than unmodified betting (ABS(Skew) is less for modified betting).
(4) Both FULL distributions are leptokurtic (KURT > 0) but FULL modified betting is less leptokurtic than FULL unmodified betting (Kurtosis is less for modified betting).
(5) Risk of Ruin of Modified betting (percentage of trips where Minimum Bankroll during Trip <= 0) ≈ 2.15% andRisk of Ruin of Unmodified Betting ≈ 0.35%.



Mean	58.735	Std Dev	15.440	Skew	-0.635	Kurtosis *	0.022	Statistics from full distribution (negative bankrolls included)
Mean	58.739	Std Dev	15.422	Skew	-0.623	Kurtosis *	-0.048	Statistics from truncated distribution:

* Excel function KURT(X) ≈ (E(X - µ)^4 / σ^4) - 3

Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

(minimum and ending bankrolls set to zero whenever minimum bankroll during trip <= 0)

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

(Current Bank) > 0.90*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size unchanged

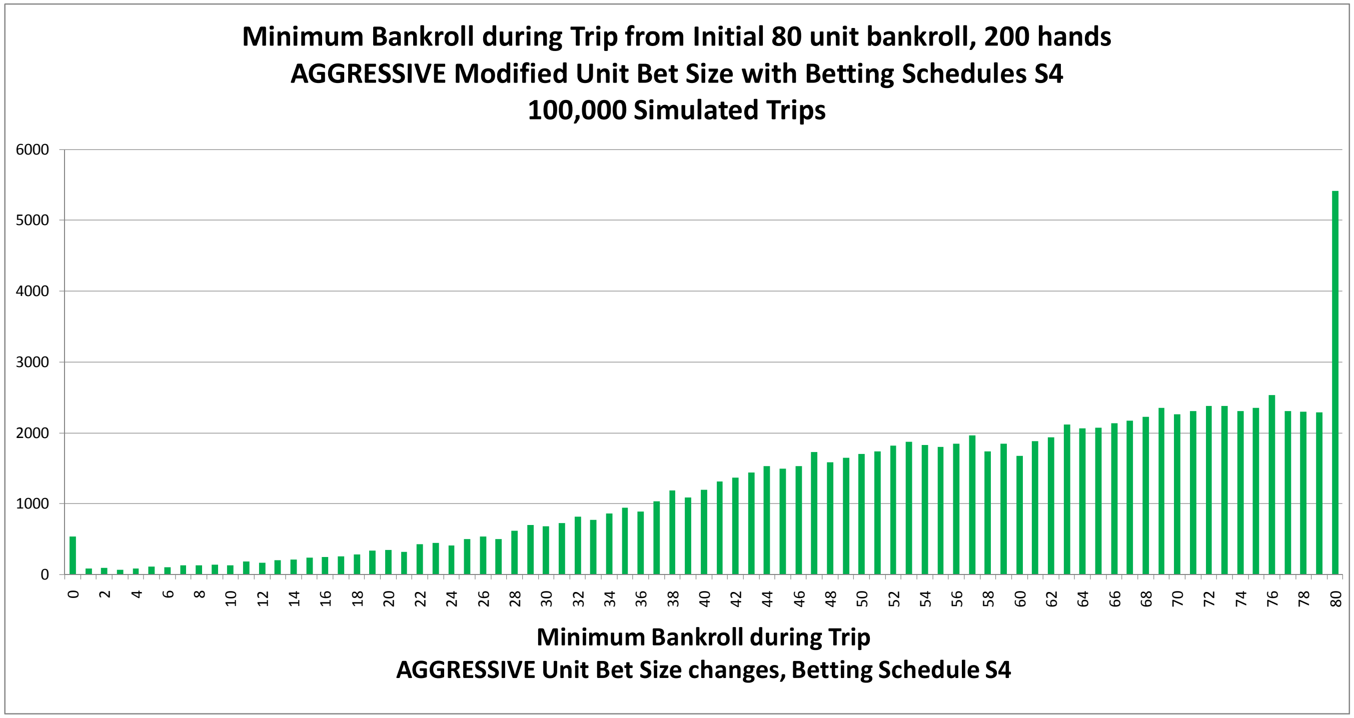
0.75*(Initial Bank) < (Cur Bank) <= 0.90*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size = 0.80*(Initial Unit Bet Size)

(Current Bank) <= 0.75*(Initial Bank):
Betting Schedule S4 unchanged
Unit Bet Size = 0.60*(Initial Unit Bet Size)

Minimum Bankroll During Trip

	Mean	Std Dev	Skew	ABS(Skew)	Kurtosis	RoR
Unmodified Betting	55.22	20.4	-0.90	0.90	0.09	2.24%
Modified Betting Sch	57.52	17.0	-0.74	0.74	0.08	0.35%
Modified Unit Bet Size	58.74	15.4	-0.62	0.62	-0.05	0.08%

Statistics from truncated distribution:
(bankroll set to zero whenever minimum bankroll during trip <= 0)



Mean 56.383 Std Dev 17.984 Skew -0.810 Kurtosis * 0.386 Statistics from full distribution (negative bankrolls included)

Mean 56.427 Std Dev 17.828 Skew -0.743 Kurtosis * 0.036 Statistics from truncated distribution:
(minimum and ending bankrolls set to zero
whenever minimum bankroll during trip <= 0)

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
S4	1	2	3	4

Unit Bet Size = 1.25*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
(Current Bank) > 1.25*(Initial Bank)
(Current Bank) > 100 units

Unit Bet Size = Initial Unit Bet Size
Betting Schedule S4 unchanged
0.75*(Initial Bank) < (Cur Bank) <= 1.25*(Initial Bank)
60 units < (Cur Bank) <= 100 units

Unit Bet Size = 0.75*(Initial Unit Bet Size)
Betting Schedule S4 unchanged
(Current Bank) <= 0.75*(Initial Bank)
(Current Bank) <= 60 units

Minimum Bankroll During Trip

	Mean	Std Dev	Skew	ABS(Skew)	Kurtosis *	RoR
Unit Bet Size Unchanced, Betting Schedule S4	55.22	20.4	-0.90	0.90	0.09	2.24%
Modified Betting Schedules: Betting Schedules S4, S3 and S2	57.52	17.0	-0.74	0.74	0.08	0.35%
Modified Unit Bet Size, Betting Schedule S4	58.74	15.4	-0.62	0.62	-0.05	0.08%
Aggressive Modified Unit Bet Size, Betting Schedule S4	56.43	17.8	-0.74	0.74	0.04	0.54%

Statistics from truncated distribution:
(bankroll set to zero whenever minimum bankroll during trip <= 0)

* Excel function KURT(X) ≈ (E(X - µ)^4 / σ^4) - 3
Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Risk of Ruin by Betting Schedule, Trip Duration and Bankroll
Six Decks, 4.5 Dealt

Betting Schedule	4	(4 = S4, 3 = S3, 2 = S2, 1 = S1)
Trip Duration (hours)	8	
Bankroll	80	
Risk of Ruin	**2.4%**	

	Betting Schedule (Units Bet)			
Red 7 tc	S4	S3	S2	S1
2	1	1	1	1
3	2	2	2	1
4	3	3	2	1
>= 5	4	3	2	1

25 hands played/hour, 40 hours/week		
Hands Played	Trip Duration	Hours Played
200	Day	8
500	Weekend	20
1,000	1 week	40
2,000	2 weeks	80
4,000	1 month	160
8,000	2 months	320

μ(1) expected one hour win

σ(1) one hour standard deviation

	Betting Schedule			
	1	2	3	4
μ(1)	0.4	0.8	1.0	1.2
σ(1)	5.9	9.6	12.1	13.8

	μ(1) 1.2		σ(1) 13.8	
hours		μ(n) = n*μ(1)	μ(n)	9.6
8		σ(n) = SQRT(n)*σ(1)	σ(n)	39.0
		Bankroll	B	80

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)

R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll

N(x) = area to the left of "x" for the standard NORMDIST with mean 0 and std dev 1.

(1)	N((-B - μ)/σ)	0.011
(2)	EXP((-2*μ*B)/σ^2)	0.365
(3)	N((-B + μ)/σ)	0.036
	R = (1) + (2)*(3)	**2.4%**

Bankroll and Bet Sizing

By Hands Played

Betting Schedule S4: Units Bet = 1, 2 and 3 at Red 7 true counts of 2, 3, 4 and >= 5

Six Decks, 4.5 Decks Dealt

Betting Schedule S4 for One Hand per Round, 1 - 4 spread

One Hour Played = 25 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		25	Betting Schedule S4				
(1) Red 7 "tc"	(2) Hand %	(3) tpa(t)	(4) Units Bet	(5) # hands played	(6)=(4)*(5)*k Amount Bet	(7) = (6) * (3) Expected Win	(8) = (5)*(4)^2
2	43.0%	0.66%	1.00	11	12	0.08	11
3	24.9%	1.21%	2.00	6	14	0.17	25
4	14.3%	1.90%	3.00	4	12	0.23	32
5	7.9%	2.71%	4.00	2	9	0.24	32
6	4.5%	3.59%	4.00	1	5	0.18	18
7	2.6%	4.46%	4.00	1	3	0.13	11
8	1.5%	5.34%	4.00	0	2	0.09	6
9	0.8%	6.21%	4.00	0	1	0.05	3
10	0.4%	7.09%	4.00	0	0	0.03	2
Total	100.0%	n/a	n/a	25	58	**1.21**	139

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 1.21 / 58	**2.08%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**13.8**	11.8
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 13.8 / 1.2	11.4	

One hour of play = 25 hands played of the six deck game, four and a half decks dealt:

μ(one hour)	1.21	≈	**1.2**	units won per hour played
σ(one hour)	13.8	≈	**14**	units

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

μ("n" hours)	=	n * μ(one hour)	=	n * 1.2
σ("n" hours)	=	SQRT(n) * σ(one hour)	=	SQRT(n) * 14

So given number of hours played, μ and σ can be calculated from μ and σ for one hour of play using above equations. Then the risk formula: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used given either "B" in which case "R" is calculated or given "R" in which case "B" is calculated.

Bankroll for various Risk of Ruin

Betting Schedule S4: Units Bet = 1, 2, 3 and 4 at Red 7 true counts of 2, 3, 4 and >= 5

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

$\mu(1) =$ 1.2 $\mu(n) =$ $n * \mu(1)$

$\sigma(1) =$ 13.8 $\sigma(n) =$ $SQRT(n) * \sigma(1)$

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	≈2.5% RoR
200	Day	8	10	39	4.0	80
500	Weekend	20	24	62	2.5	120
1,000	1 week	40	48	87	1.8	160
2,000	2 weeks	80	97	123	1.3	200
4,000	1 month	160	194	174	0.9	240
8,000	2 months	320	388	247	0.6	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
10	74.4%	81.0%	84.1%	86.2%	87.3%	87.8%
15	63.2%	72.4%	77.0%	79.9%	81.6%	82.3%
20	53.0%	64.5%	70.3%	74.0%	76.2%	77.1%
25	43.9%	57.2%	64.0%	68.5%	71.1%	72.3%
30	36.0%	50.5%	58.2%	63.4%	66.3%	67.7%
35	29.1%	44.4%	52.9%	58.5%	61.9%	63.5%
40	23.3%	38.8%	47.9%	54.1%	57.7%	59.4%
45	18.3%	33.8%	43.3%	49.9%	53.8%	55.7%
50	14.3%	29.3%	39.0%	46.0%	50.2%	52.2%
55	10.9%	25.3%	35.1%	42.3%	46.7%	48.8%
60	8.3%	21.7%	31.5%	38.9%	43.5%	45.7%
65	6.2%	18.5%	28.2%	35.8%	40.5%	42.8%
70	4.5%	15.7%	25.2%	32.8%	37.7%	40.1%
75	3.3%	13.3%	22.5%	30.1%	35.1%	37.5%
80	2.4%	11.1%	20.0%	27.6%	32.6%	35.1%
85	1.7%	9.3%	17.7%	25.2%	30.3%	32.9%
90	1.2%	7.7%	15.7%	23.1%	28.2%	30.8%
95	0.8%	6.4%	13.8%	21.1%	26.2%	28.8%
100	0.5%	5.3%	12.2%	19.2%	24.3%	27.0%
105	0.4%	4.3%	10.7%	17.5%	22.6%	25.2%
110	0.2%	3.5%	9.4%	15.9%	20.9%	23.6%
115	0.1%	2.8%	8.2%	14.5%	19.4%	22.1%
120	0.1%	2.3%	7.1%	13.2%	18.0%	20.6%
125	0.1%	1.8%	6.2%	11.9%	16.7%	19.3%
130	0.0%	1.4%	5.4%	10.8%	15.4%	18.0%
135	0.0%	1.1%	4.6%	9.8%	14.3%	16.9%
140	0.0%	0.9%	4.0%	8.8%	13.2%	15.8%

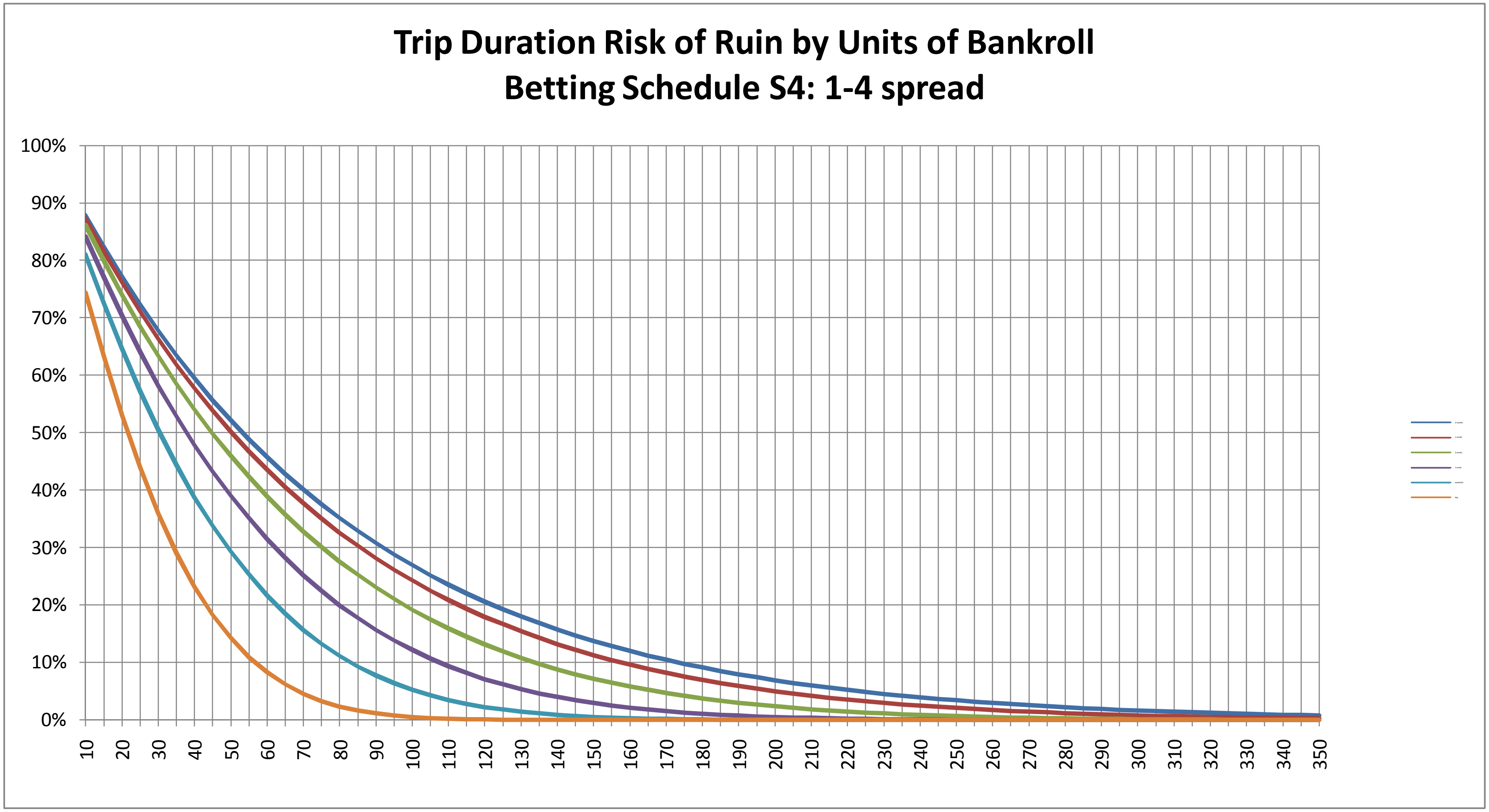
	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
145	0.0%	0.7%	3.4%	8.0%	12.2%	14.7%
150	0.0%	0.5%	2.9%	7.2%	11.3%	13.8%
155	0.0%	0.4%	2.5%	6.5%	10.4%	12.9%
160	0.0%	0.3%	2.1%	5.8%	9.6%	12.0%
165	0.0%	0.2%	1.8%	5.2%	8.9%	11.2%
170	0.0%	0.2%	1.5%	4.7%	8.2%	10.5%
175	0.0%	0.1%	1.3%	4.2%	7.6%	9.8%
180	0.0%	0.1%	1.1%	3.8%	7.0%	9.1%
185	0.0%	0.1%	0.9%	3.4%	6.4%	8.5%
190	0.0%	0.1%	0.8%	3.0%	5.9%	8.0%
195	0.0%	0.0%	0.6%	2.7%	5.4%	7.4%
200	0.0%	0.0%	0.5%	2.4%	5.0%	6.9%
205	0.0%	0.0%	0.4%	2.1%	4.6%	6.5%
210	0.0%	0.0%	0.4%	1.9%	4.2%	6.0%
215	0.0%	0.0%	0.3%	1.7%	3.9%	5.6%
220	0.0%	0.0%	0.3%	1.5%	3.6%	5.2%
225	0.0%	0.0%	0.2%	1.3%	3.3%	4.9%
230	0.0%	0.0%	0.2%	1.1%	3.0%	4.6%
235	0.0%	0.0%	0.1%	1.0%	2.7%	4.2%
240	0.0%	0.0%	0.1%	0.9%	2.5%	4.0%
245	0.0%	0.0%	0.1%	0.8%	2.3%	3.7%
250	0.0%	0.0%	0.1%	0.7%	2.1%	3.4%
255	0.0%	0.0%	0.1%	0.6%	1.9%	3.2%
260	0.0%	0.0%	0.0%	0.5%	1.7%	3.0%
265	0.0%	0.0%	0.0%	0.5%	1.6%	2.8%
270	0.0%	0.0%	0.0%	0.4%	1.5%	2.6%
275	0.0%	0.0%	0.0%	0.4%	1.3%	2.4%
280	0.0%	0.0%	0.0%	0.3%	1.2%	2.2%
285	0.0%	0.0%	0.0%	0.3%	1.1%	2.1%
290	0.0%	0.0%	0.0%	0.2%	1.0%	1.9%
295	0.0%	0.0%	0.0%	0.2%	0.9%	1.8%
300	0.0%	0.0%	0.0%	0.2%	0.8%	1.7%
305	0.0%	0.0%	0.0%	0.1%	0.7%	1.5%
310	0.0%	0.0%	0.0%	0.1%	0.7%	1.4%
315	0.0%	0.0%	0.0%	0.1%	0.6%	1.3%
320	0.0%	0.0%	0.0%	0.1%	0.6%	1.2%
325	0.0%	0.0%	0.0%	0.1%	0.5%	1.1%
330	0.0%	0.0%	0.0%	0.1%	0.5%	1.1%
335	0.0%	0.0%	0.0%	0.1%	0.4%	1.0%
340	0.0%	0.0%	0.0%	0.1%	0.4%	0.9%
345	0.0%	0.0%	0.0%	0.0%	0.3%	0.8%
350	0.0%	0.0%	0.0%	0.0%	0.3%	0.8%

Risk of Ruin

By Bankroll

Betting Schedule S4: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5

Six Decks, 4.5 Decks Dealt



$R = N((-B - \mu)/\sigma) + EXP((-2*\mu*B)/\sigma^2) * N((-B + \mu)/\sigma)$ R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

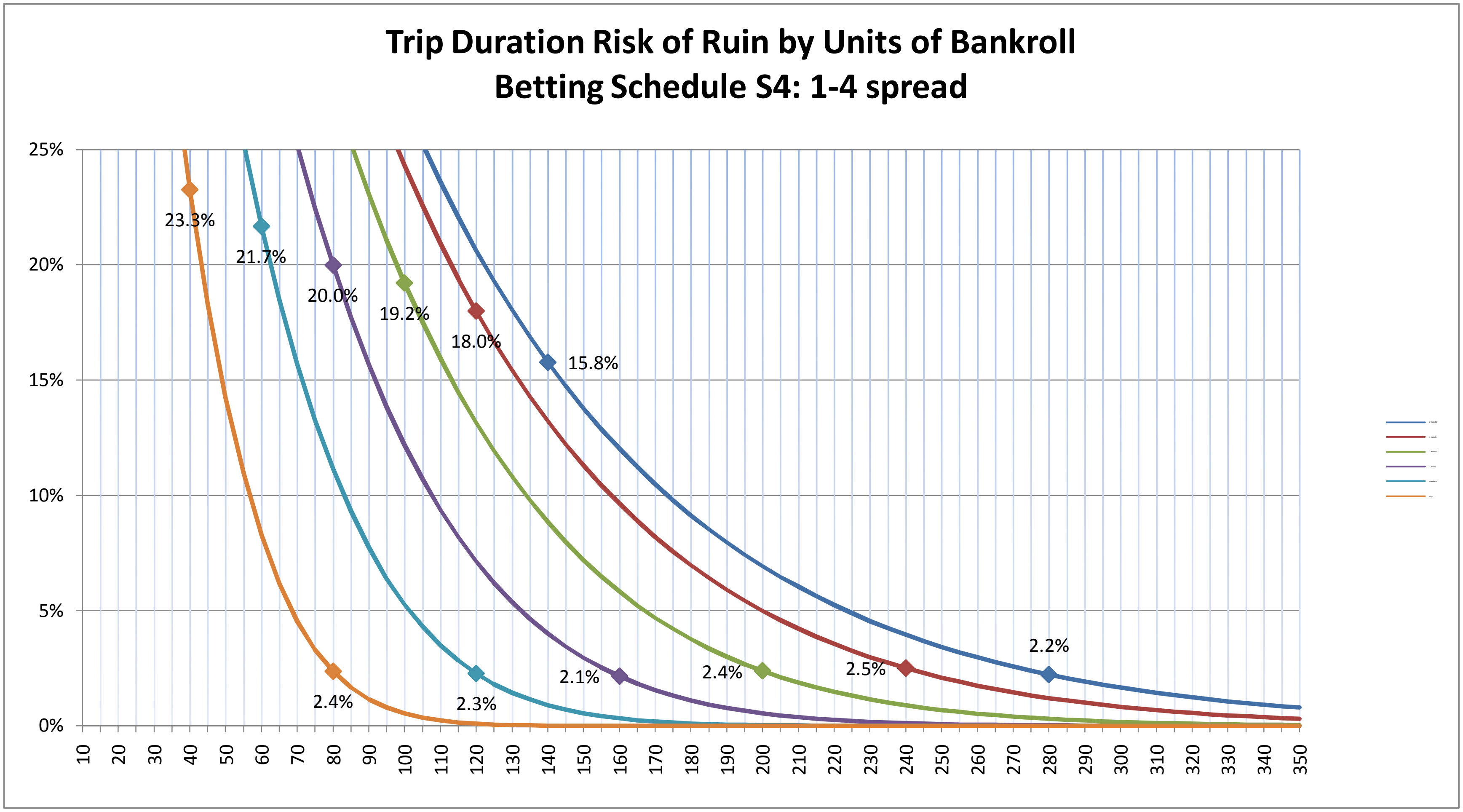
N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

Risk of Ruin

By Bankroll

Betting Schedule S4: Units Bet = 1, 2, 3 and 4 at Red 7 true counts 2, 3, 4 and >= 5

Six Decks, 4.5 Decks Dealt



Approximate Units of Bankroll by Trip Duration and Risk of Ruin (RoR): 1-4 spread						
Trip Duration	day	weekend	week	2 weeks	month	2 months
≈ 2.5% RoR	80	120	160	200	240	280
≈ 20% RoR	40	60	80	100	120	140

Bankroll and Bet Sizing

By Hands Played

Betting Schedule S3: Units Bet = 1, 2 and 3 at Red 7 true counts of 2, 3 and >= 4

Six Decks, 4.5 Decks Dealt

Betting Schedule S3 for One Hand per Round, 1 - 3 spread

One Hour Played = 25 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		25	Betting Schedule S3				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1.00	11	12	0.08	11
3	24.9%	1.21%	2.00	6	14	0.17	25
4	14.3%	1.90%	3.00	4	12	0.23	32
5	7.9%	2.71%	3.00	2	7	0.18	18
6	4.5%	3.59%	3.00	1	4	0.14	10
7	2.6%	4.46%	3.00	1	2	0.10	6
8	1.5%	5.34%	3.00	0	1	0.07	3
9	0.8%	6.21%	3.00	0	1	0.04	2
10	0.4%	7.09%	3.00	0	0	0.02	1
Total	100.0%	n/a	n/a	**25**	53	**1.03**	108

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 1.03 / 53	**1.93%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**12.1**	10.4
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 12.1 / 1	11.8	

<u>One hour of play = 25 hands played of the six deck game, four and a half decks dealt:</u>

μ(one hour)	1.03	≈	**1.0**	units won per hour played
σ(one hour)	12.1	≈	**12**	units

<u>"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:</u>

μ("n" hours)	=	n * μ(one hour)	=	n * 1
σ("n" hours)	=	SQRT(n) * σ(one hour)	=	SQRT(n) * 12

So given number of hours played, μ and σ can be calculated from μ and σ for one hour of play using above equations. Then the risk formula: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used given either "B" in which case "R" is calculated or given "R" in which case "B" is calculated.

Bankroll for various Risk of Ruin

Betting Schedule S3: Units Bet = 1, 2 and 3 at Red 7 true counts of 2, 3 and >= 4

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

$\mu(1) =$ 1.0 $\mu(n) =$ n * $\mu(1)$

$\sigma(1) =$ 12.1 $\sigma(n) =$ SQRT(n) * $\sigma(1)$

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	≈1% RoR
200	Day	8	8	34	4.2	80
500	Weekend	20	21	54	2.6	120
1,000	1 week	40	41	77	1.9	160
2,000	2 weeks	80	82	109	1.3	200
4,000	1 month	160	165	154	0.9	240
8,000	2 months	320	329	217	0.7	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
10	71.5%	78.9%	82.5%	84.8%	86.1%	86.7%
15	59.2%	69.5%	74.6%	77.9%	79.9%	80.8%
20	48.3%	60.9%	67.4%	71.6%	74.0%	75.2%
25	38.8%	53.1%	60.6%	65.7%	68.6%	70.0%
30	30.6%	46.0%	54.4%	60.2%	63.6%	65.2%
35	23.8%	39.6%	48.7%	55.1%	58.8%	60.7%
40	18.2%	33.9%	43.5%	50.3%	54.5%	56.5%
45	13.7%	28.8%	38.7%	45.9%	50.4%	52.6%
50	10.1%	24.3%	34.4%	41.9%	46.6%	48.9%
55	7.3%	20.4%	30.5%	38.2%	43.1%	45.5%
60	5.2%	17.0%	26.9%	34.7%	39.8%	42.3%
65	3.6%	14.1%	23.6%	31.5%	36.7%	39.4%
70	2.5%	11.6%	20.7%	28.6%	33.9%	36.6%
75	1.7%	9.5%	18.1%	25.9%	31.3%	34.1%
80	1.1%	7.7%	15.8%	23.4%	28.8%	31.7%
85	0.7%	6.2%	13.7%	21.2%	26.6%	29.4%
90	0.5%	5.0%	11.9%	19.1%	24.5%	27.4%
95	0.3%	3.9%	10.3%	17.2%	22.5%	25.4%
100	0.2%	3.1%	8.8%	15.5%	20.7%	23.6%
105	0.1%	2.4%	7.6%	13.9%	19.0%	21.9%
110	0.1%	1.9%	6.5%	12.5%	17.5%	20.4%
115	0.0%	1.5%	5.5%	11.2%	16.1%	18.9%
120	0.0%	1.1%	4.7%	10.0%	14.7%	17.6%
125	0.0%	0.8%	3.9%	8.9%	13.5%	16.3%
130	0.0%	0.6%	3.3%	7.9%	12.4%	15.1%
135	0.0%	0.5%	2.8%	7.1%	11.3%	14.0%
140	0.0%	0.4%	2.3%	6.3%	10.4%	13.0%
145	0.0%	0.3%	1.9%	5.6%	9.5%	12.1%
150	0.0%	0.2%	1.6%	4.9%	8.7%	11.2%
155	0.0%	0.1%	1.3%	4.4%	7.9%	10.4%
160	0.0%	0.1%	1.1%	3.8%	7.2%	9.6%
165	0.0%	0.1%	0.9%	3.4%	6.6%	8.9%
170	0.0%	0.1%	0.7%	3.0%	6.0%	8.3%
175	0.0%	0.0%	0.6%	2.6%	5.5%	7.7%
180	0.0%	0.0%	0.5%	2.3%	5.0%	7.1%

Bankroll for various Risk of Ruin

Betting Schedule S3: Units Bet = 1, 2 and 3 at Red 7 true counts of 2, 3 and >= 4

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

$\mu(1) =$ 1.0 $\mu(n) =$ n * $\mu(1)$

$\sigma(1) =$ 12.1 $\sigma(n) =$ SQRT(n) * $\sigma(1)$

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	≈1% RoR
200	Day	8	8	34	4.2	80
500	Weekend	20	21	54	2.6	120
1,000	1 week	40	41	77	1.9	160
2,000	2 weeks	80	82	109	1.3	200
4,000	1 month	160	165	154	0.9	240
8,000	2 months	320	329	217	0.7	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)   R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
185	0.0%	0.0%	0.4%	2.0%	4.5%	6.6%
190	0.0%	0.0%	0.3%	1.7%	4.1%	6.1%
195	0.0%	0.0%	0.3%	1.5%	3.7%	5.6%
200	0.0%	0.0%	0.2%	1.3%	3.4%	5.2%
205	0.0%	0.0%	0.2%	1.2%	3.1%	4.8%
210	0.0%	0.0%	0.1%	1.0%	2.8%	4.5%
215	0.0%	0.0%	0.1%	0.9%	2.5%	4.1%
220	0.0%	0.0%	0.1%	0.7%	2.3%	3.8%
225	0.0%	0.0%	0.1%	0.6%	2.1%	3.5%
230	0.0%	0.0%	0.0%	0.6%	1.9%	3.2%
235	0.0%	0.0%	0.0%	0.5%	1.7%	3.0%
240	0.0%	0.0%	0.0%	0.4%	1.5%	2.8%
245	0.0%	0.0%	0.0%	0.4%	1.4%	2.6%
250	0.0%	0.0%	0.0%	0.3%	1.2%	2.4%
255	0.0%	0.0%	0.0%	0.3%	1.1%	2.2%
260	0.0%	0.0%	0.0%	0.2%	1.0%	2.0%
265	0.0%	0.0%	0.0%	0.2%	0.9%	1.8%
270	0.0%	0.0%	0.0%	0.2%	0.8%	1.7%
275	0.0%	0.0%	0.0%	0.1%	0.7%	1.6%
280	0.0%	0.0%	0.0%	0.1%	0.6%	1.4%
285	0.0%	0.0%	0.0%	0.1%	0.6%	1.3%
290	0.0%	0.0%	0.0%	0.1%	0.5%	1.2%
295	0.0%	0.0%	0.0%	0.1%	0.5%	1.1%
300	0.0%	0.0%	0.0%	0.1%	0.4%	1.0%
305	0.0%	0.0%	0.0%	0.0%	0.4%	1.0%
310	0.0%	0.0%	0.0%	0.0%	0.3%	0.9%
315	0.0%	0.0%	0.0%	0.0%	0.3%	0.8%
320	0.0%	0.0%	0.0%	0.0%	0.3%	0.7%
325	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%
330	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%
335	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%
340	0.0%	0.0%	0.0%	0.0%	0.2%	0.5%
345	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%
350	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%

Bankroll and Bet Sizing

By Hands Played

Betting Schedule S2: Units Bet = 1, 2 at Red 7 true counts of 2 and >= 3

Six Decks, 4.5 Decks Dealt

Betting Schedule S2 for One Hand per Round, 1 - 2 spread

One Hour Played = 25 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		25	Betting Schedule S2				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1.00	11	12	0.08	11
3	24.9%	1.21%	2.00	6	14	0.17	25
4	14.3%	1.90%	2.00	4	8	0.15	14
5	7.9%	2.71%	2.00	2	4	0.12	8
6	4.5%	3.59%	2.00	1	3	0.09	5
7	2.6%	4.46%	2.00	1	1	0.07	3
8	1.5%	5.34%	2.00	0	1	0.05	2
9	0.8%	6.21%	2.00	0	0	0.03	1
10	0.4%	7.09%	2.00	0	0	0.02	0
Total	100.0%	n/a	n/a	25	44	**0.77**	68

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 0.77 / 44	**1.74%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**9.6**	8.2
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 9.6 / 0.8	12.5	

<u>One hour of play = 25 hands played of the six deck game, four and a half decks dealt:</u>

μ(one hour)	0.77	≈	**0.8**	units won per hour played
σ(one hour)	9.6	≈	**10**	units

<u>"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:</u>

μ("n" hours)	=	n * μ(one hour)	=	n * 0.8
σ("n" hours)	=	SQRT(n) * σ(one hour)	=	SQRT(n) * 10

So given number of hours played, μ and σ can be calculated from μ and σ for one hour of play using above equations. Then the risk formula: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used given either "B" in which case "R" is calculated or given "R" in which case "B" is calculated.

Bankroll for various Risk of Ruin

Betting Schedule S2: Units Bet = 1, 2 at Red 7 true counts of 2 and >= 3

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

μ(1) =	0.8	μ(n) =	n * μ(1)
σ(1) =	9.6	σ(n) =	SQRT(n) * σ(1)

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	≈0.5% RoR
200	Day	8	6	27	4.4	80
500	Weekend	20	15	43	2.8	120
1,000	1 week	40	31	61	2.0	160
2,000	2 weeks	80	62	86	1.4	200
4,000	1 month	160	123	122	1.0	240
8,000	2 months	320	246	172	0.7	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)   R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
10	65.3%	74.3%	78.8%	81.7%	83.5%	84.3%
15	50.9%	63.3%	69.6%	73.7%	76.2%	77.4%
20	38.8%	53.4%	61.1%	66.4%	69.5%	71.1%
25	28.8%	44.6%	53.5%	59.6%	63.4%	65.2%
30	20.8%	36.9%	46.6%	53.5%	57.7%	59.9%
35	14.6%	30.2%	40.4%	47.9%	52.5%	54.9%
40	10.0%	24.5%	34.9%	42.8%	47.8%	50.4%
45	6.7%	19.7%	30.0%	38.1%	43.4%	46.2%
50	4.3%	15.6%	25.6%	33.9%	39.4%	42.3%
55	2.7%	12.3%	21.8%	30.1%	35.8%	38.8%
60	1.6%	9.5%	18.5%	26.7%	32.4%	35.6%
65	1.0%	7.3%	15.6%	23.6%	29.4%	32.6%
70	0.6%	5.6%	13.0%	20.8%	26.6%	29.8%
75	0.3%	4.2%	10.9%	18.3%	24.0%	27.3%
80	0.2%	3.1%	9.0%	16.0%	21.7%	25.0%
85	0.1%	2.3%	7.4%	14.0%	19.6%	22.9%
90	0.0%	1.7%	6.1%	12.2%	17.6%	20.9%
95	0.0%	1.2%	5.0%	10.7%	15.9%	19.1%
100	0.0%	0.8%	4.0%	9.3%	14.3%	17.5%
105	0.0%	0.6%	3.2%	8.0%	12.8%	16.0%
110	0.0%	0.4%	2.6%	6.9%	11.5%	14.6%
115	0.0%	0.3%	2.1%	6.0%	10.3%	13.3%
120	0.0%	0.2%	1.6%	5.1%	9.3%	12.2%
125	0.0%	0.1%	1.3%	4.4%	8.3%	11.1%
130	0.0%	0.1%	1.0%	3.8%	7.4%	10.1%
135	0.0%	0.1%	0.8%	3.2%	6.6%	9.2%
140	0.0%	0.0%	0.6%	2.7%	5.9%	8.4%
145	0.0%	0.0%	0.5%	2.3%	5.3%	7.7%
150	0.0%	0.0%	0.4%	2.0%	4.7%	7.0%
155	0.0%	0.0%	0.3%	1.7%	4.2%	6.4%
160	0.0%	0.0%	0.2%	1.4%	3.7%	5.8%
165	0.0%	0.0%	0.2%	1.2%	3.3%	5.3%
170	0.0%	0.0%	0.1%	1.0%	2.9%	4.8%
175	0.0%	0.0%	0.1%	0.8%	2.6%	4.3%
180	0.0%	0.0%	0.1%	0.7%	2.3%	3.9%

Bankroll for various Risk of Ruin

Betting Schedule S2: Units Bet = 1, 2 at Red 7 true counts of 2 and >= 3

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

$\mu(1) =$ 0.8 $\mu(n) =$ n * $\mu(1)$

$\sigma(1) =$ 9.6 $\sigma(n) =$ SQRT(n) * $\sigma(1)$

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	≈0.5% RoR
200	Day	8	6	27	4.4	80
500	Weekend	20	15	43	2.8	120
1,000	1 week	40	31	61	2.0	160
2,000	2 weeks	80	62	86	1.4	200
4,000	1 month	160	123	122	1.0	240
8,000	2 months	320	246	172	0.7	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)   R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
185	0.0%	0.0%	0.0%	0.6%	2.0%	3.6%
190	0.0%	0.0%	0.0%	0.5%	1.8%	3.3%
195	0.0%	0.0%	0.0%	0.4%	1.5%	2.9%
200	0.0%	0.0%	0.0%	0.3%	1.4%	2.7%
205	0.0%	0.0%	0.0%	0.3%	1.2%	2.4%
210	0.0%	0.0%	0.0%	0.2%	1.0%	2.2%
215	0.0%	0.0%	0.0%	0.2%	0.9%	2.0%
220	0.0%	0.0%	0.0%	0.1%	0.8%	1.8%
225	0.0%	0.0%	0.0%	0.1%	0.7%	1.6%
230	0.0%	0.0%	0.0%	0.1%	0.6%	1.5%
235	0.0%	0.0%	0.0%	0.1%	0.5%	1.3%
240	0.0%	0.0%	0.0%	0.1%	0.5%	1.2%
245	0.0%	0.0%	0.0%	0.0%	0.4%	1.1%
250	0.0%	0.0%	0.0%	0.0%	0.3%	1.0%
255	0.0%	0.0%	0.0%	0.0%	0.3%	0.9%
260	0.0%	0.0%	0.0%	0.0%	0.3%	0.8%
265	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%
270	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%
275	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%
280	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%
285	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%
290	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
295	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
300	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
305	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
310	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
315	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
320	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
325	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
330	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
335	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
340	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
345	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
350	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%

Bankroll and Bet Sizing

By Hands Played

Betting Schedule S1: Units Bet = 1 at Red 7 true counts >= 2

Six Decks, 4.5 Decks Dealt

Betting Schedule S1 for One Hand per Round, flat betting

One Hour Played = 25 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		25	Betting Schedule S1				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1.00	11	12	0.08	11
3	24.9%	1.21%	1.00	6	7	0.09	6
4	14.3%	1.90%	1.00	4	4	0.08	4
5	7.9%	2.71%	1.00	2	2	0.06	2
6	4.5%	3.59%	1.00	1	1	0.05	1
7	2.6%	4.46%	1.00	1	1	0.03	1
8	1.5%	5.34%	1.00	0	0	0.02	0
9	0.8%	6.21%	1.00	0	0	0.01	0
10	0.4%	7.09%	1.00	0	0	0.01	0
Total	100.0%	n/a	n/a	**25**	28	**0.42**	25

Column (5) = (# of Hands Played) * Column (2)
tpa(t) = total player advantage at true count "t"
= betting advantage (ba) + strategy gain (sg)

Players Advantage = 0.42 / 28	**1.51%**	SQRT:
Standard Deviation = SQRT(Tot (8)) * 1.17	**5.9**	5.0
Standard Deviation / Expected Win = 5.9 / 0.4	13.8	

One hour of play = 25 hands played of the six deck game, four and a half decks dealt:

μ(one hour)	0.42	≈	**0.4**	units won per hour played
σ(one hour)	5.9	≈	**6**	units

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

μ("n" hours)	=	n * μ(one hour)	=	n * 0.4
σ("n" hours)	=	SQRT(n) * σ(one hour)	=	SQRT(n) * 6

So given number of hours played, μ and σ can be calculated from μ and σ for one hour of play using above equations. Then the risk formula: R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ), can be used given either "B" in which case "R" is calculated or given "R" in which case "B" is calculated.

Bankroll for various Risk of Ruin

Betting Schedule S1: Units Bet = 1 at Red 7 true counts >= 2

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

$\mu(1) =$ 0.4 $\mu(n) =$ $n * \mu(1)$

$\sigma(1) =$ 5.9 $\sigma(n) =$ $SQRT(n) * \sigma(1)$

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	< 0.1% RoR
200	Day	8	3	17	4.9	80
500	Weekend	20	8	26	3.1	120
1,000	1 week	40	17	37	2.2	160
2,000	2 weeks	80	34	52	1.5	200
4,000	1 month	160	68	74	1.1	240
8,000	2 months	320	136	105	0.8	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
10	47.8%	61.2%	68.1%	72.8%	75.7%	77.3%
15	30.0%	46.1%	55.3%	61.7%	65.7%	67.8%
20	17.5%	33.9%	44.3%	52.0%	56.9%	59.5%
25	9.5%	24.2%	35.1%	43.5%	49.1%	52.2%
30	4.7%	16.8%	27.4%	36.3%	42.3%	45.7%
35	2.2%	11.3%	21.1%	30.0%	36.4%	40.0%
40	0.9%	7.4%	16.1%	24.7%	31.2%	35.0%
45	0.4%	4.7%	12.0%	20.2%	26.7%	30.6%
50	0.1%	2.9%	8.9%	16.4%	22.8%	26.7%
55	0.0%	1.7%	6.5%	13.2%	19.4%	23.3%
60	0.0%	1.0%	4.6%	10.6%	16.4%	20.3%
65	0.0%	0.6%	3.3%	8.4%	13.9%	17.7%
70	0.0%	0.3%	2.3%	6.7%	11.7%	15.4%
75	0.0%	0.2%	1.6%	5.2%	9.9%	13.4%
80	0.0%	0.1%	1.0%	4.1%	8.3%	11.6%
85	0.0%	0.0%	0.7%	3.1%	6.9%	10.1%
90	0.0%	0.0%	0.5%	2.4%	5.7%	8.7%
95	0.0%	0.0%	0.3%	1.8%	4.8%	7.5%
100	0.0%	0.0%	0.2%	1.4%	3.9%	6.5%
105	0.0%	0.0%	0.1%	1.0%	3.2%	5.6%
110	0.0%	0.0%	0.1%	0.8%	2.7%	4.8%
115	0.0%	0.0%	0.0%	0.6%	2.2%	4.2%
120	0.0%	0.0%	0.0%	0.4%	1.8%	3.6%
125	0.0%	0.0%	0.0%	0.3%	1.4%	3.1%
130	0.0%	0.0%	0.0%	0.2%	1.2%	2.6%
135	0.0%	0.0%	0.0%	0.2%	0.9%	2.2%
140	0.0%	0.0%	0.0%	0.1%	0.8%	1.9%
145	0.0%	0.0%	0.0%	0.1%	0.6%	1.6%
150	0.0%	0.0%	0.0%	0.1%	0.5%	1.4%
155	0.0%	0.0%	0.0%	0.0%	0.4%	1.2%
160	0.0%	0.0%	0.0%	0.0%	0.3%	1.0%
165	0.0%	0.0%	0.0%	0.0%	0.2%	0.9%
170	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%
175	0.0%	0.0%	0.0%	0.0%	0.1%	0.6%
180	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%

Bankroll for various Risk of Ruin

Betting Schedule S1: Units Bet = 1 at Red 7 true counts >= 2

"n" hour of play = (25*n) hands played of the six deck game, four and a half decks dealt:

μ(1) =	0.4	μ(n) =	n * μ(1)
σ(1) =	5.9	σ(n) =	SQRT(n) * σ(1)

25 hands played/hour, 40 hours/week						
Hands Played	Trip Duration	Hours Played	μ = Exp. Win	σ = Std Dev	σ / μ	< 0.1% RoR
200	Day	8	3	17	4.9	80
500	Weekend	20	8	26	3.1	120
1,000	1 week	40	17	37	2.2	160
2,000	2 weeks	80	34	52	1.5	200
4,000	1 month	160	68	74	1.1	240
8,000	2 months	320	136	105	0.8	280

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ)   R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,

N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)

	Risk of Ruin					
Bankroll	Day	Weekend	1 week	2 weeks	1 month	2 months
185	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
190	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%
195	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
200	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
205	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
210	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
215	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
220	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
225	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
230	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
235	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
240	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
245	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
250	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
255	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
260	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
265	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
270	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
275	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
280	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
285	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
290	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
295	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
300	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
305	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
310	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
315	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
320	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
325	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
330	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
335	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
340	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
345	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
350	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Comparison of 1-4 and 1-12 Betting Spreads
Betting Schedule S4, 1 to 4 spread compared to BJA, 1 to 12 spread
Six Decks, 4.5 Decks Dealt

BJA Table 8.4
One hour of playing

6 decks, 75% dealt, Hi-Low count, 1 -12 spread, 27 hands/hour		BJA Table 8.4 betting schedule approximated below:	
μ(one hour)	1.68	μ(one hour)	1.67
σ(one hour)	24.32	σ(one hour)	23.9

One Hour Played = 27 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		27	1 to 12 betting spread				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
1	43.9%	0.09%	1	12	13	0.01	12
2	24.2%	0.66%	2	7	15	0.10	26
3	14.0%	1.21%	3	4	13	0.15	34
4	8.1%	1.90%	4	2	10	0.19	35
5	4.4%	2.71%	9	1	12	0.33	97
6	2.5%	3.59%	12	1	9	0.33	99
7	1.5%	4.46%	12	0	5	0.24	58
8	0.8%	5.34%	12	0	3	0.17	33
9	0.4%	6.21%	12	0	2	0.10	16
10	0.2%	7.09%	12	0	1	0.05	8
Total	100.0%	n/a	n/a	27	83	**1.67**	418

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 1.67 / 83	**2.02%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**23.9**	20.4
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 23.9 / 1.7	14.3	

Bankroll Required for Risk of Ruin = 20%						
1 to 12 betting spread						
Risk of Ruin, 27 hands played/hour, 40 hours/week						
Trip Duration	Hours Played	Hands Played	Bankroll	μ = Exp. Win	σ = Std Dev	Risk of Ruin
One Hour	1	27	30	1.67	23.9	19.2%
Day	8	216	78	13	68	19.6%
Weekend	20	540	114	33	107	20.0%
1 week	40	1,080	149	67	151	20.0%
2 weeks	80	2,160	188	134	214	20.0%
1 month	160	4,320	226	267	303	20.0%
2 months	320	8,640	255	534	428	20.0%

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bankroll,
N(x) = area to the left of "x" for the standard NORMDIST with mean zero and standard deviation one = NORMDIST(x,0,1,TRUE)
μ(h) = Exp Win for "h" hours played μ(h) = μ(1) * h
σ(h) = Std Dev for "h" hours played σ(h) = σ(1) * SQRT(h)

Exhibit F1d:
G(x) = Cumulative Distribution Function of X = Red 7 true count for six decks, 4.5 decks dealt = P(X <= x)
P(X integer > 2) = P(X > 1.5) = 1 - G(1.5) = 1 - 0.791 = 0.209
P(X integer > 1) = P(X > 0.5) = 1 - G(0.5) = 1 - 0.627 = 0.373
P(X integer > 2) / P(X integer > 1) = 56.0%
Player 1-4 playing only tc >= 2 makes only 56% of the bets made by the 1-12 player who plays at tc >= 1.
Player 1-12 is playing 44% of the time in mediocrity (tc = 1), which adds nothing to the expected win and only increases variance.
Player 1-4 enters games at tc >=2 while 1-12 player enters at tc >= 1 and plays 27 hands per hour so player 1-4 plays 56%*27 ≈ 16 hands/hour.
Player 1-12 has high standard deviation because of playing (one unit) 44% of the time at tc = 1 and high 12 unit maximum bet.

Comparison of 1-4 and 1-12 Betting Spreads

Betting Schedule S4, 1 to 4 spread compared to BJA, 1 to 12 spread

Six Decks, 4.5 Decks Dealt

One Hour Played = 16 Hands Played (to be consistent with 1-12 player's 27 hands player/hour)

			k = double & split factor		k =	1.126	
Number of Hands Played		16	Betting Schedule S4: 1 to 4 spread				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	1	7	8	0.05	7
3	24.9%	1.21%	2	4	9	0.11	16
4	14.3%	1.90%	3	2	8	0.15	21
5	7.9%	2.71%	4	1	6	0.15	20
6	4.5%	3.59%	4	1	3	0.12	12
7	2.6%	4.46%	4	0	2	0.08	7
8	1.5%	5.34%	4	0	1	0.06	4
9	0.8%	6.21%	4	0	1	0.03	2
10	0.4%	7.09%	4	0	0	0.02	1
Total	100.0%	n/a	n/a	16	37	**0.78**	89

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 0.78 / 37	**2.08%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**11.0**	9.4
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 11 / 0.8	14.2	

μ(1) = Expected Win from one hour of play		
1-12 player	μ(1) =	1.67
1-4 player	μ(1) =	0.78
1-12 μ(1) / 1-4 μ(1) =		2.15

Unit bet size of 1-4 player needs to be increased by 115% to get same expected hourly win rate as 1-12 player.
Lower standard deviation of 1-4 player comes at a cost of lower hourly win rate.

One Hour Played = 16 Hands Played

			k = double & split factor		k =	1.126	
Number of Hands Played		16	1 to 4 spread with Unit Bet Size increased 115%				
(1)	(2)	(3)	(4)	(5)	(6)=(4)*(5)*k	(7) = (6) * (3)	(8)
Red 7 "tc"	Hand %	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (5)*(4)^2
2	43.0%	0.66%	2.15	7	17	0.11	32
3	24.9%	1.21%	4.30	4	19	0.23	74
4	14.3%	1.90%	6.45	2	17	0.32	95
5	7.9%	2.71%	8.60	1	12	0.33	94
6	4.5%	3.59%	8.60	1	7	0.25	54
7	2.6%	4.46%	8.60	0	4	0.18	31
8	1.5%	5.34%	8.60	0	2	0.12	18
9	0.8%	6.21%	8.60	0	1	0.07	9
10	0.4%	7.09%	8.60	0	1	0.04	4
Total	100.0%	n/a	n/a	16	80	**1.67**	411

Column (5) = (# of Hands Played) * Column (2)	Players Advantage = 1.67 / 80	**2.08%**	SQRT:
tpa(t) = total player advantage at true count "t"	Standard Deviation = SQRT(Tot (8)) * 1.17	**23.7**	20.3
= betting advantage (ba) + strategy gain (sg)	Standard Deviation / Expected Win = 23.7 / 1.7	14.2	

With 1-4 player's unit bet sized increased 115%, expected hourly win is same as 1-12 better and hourly standard deviation of 23.7 is just slightly lower than the 1-12 player's hourly standard deviation of 23.9 shown in 1-12 schedule above.
So to make 1-4 player's hourly expectation the same as 1-12 players, just increase the unit bet size the 1-4 player.
1-12 player would be labeled as a counter quicker than 1-4 player. So 1-4 betting schedule should be preferred.

Comparison of 1-4 and 1-12 Betting Spreads

Betting Schedule S4, 1 to 4 spread compared to BJA, 1 to 12 spread

Six Decks, 4.5 Decks Dealt

Betting Schedules		
Red 7 true count	1-12 spread Units Bet	1-4 spread Units Bet
1	1	0
2	2	1
3	3	2
4	4	3
5	9	4
6	12	4
7	12	4
8	12	4
9	12	4
10	12	4

The reduction in RoR of the 1-4 player comes at a cost of lower μ(1) = hourly expected win rate as shown in the chart below.
If unit bet size of 1-4 player is increased 115% then both the 1-4 and the 1-12 player have around the same μ(1).
When μ(1) of 1-4 and 1-12 player are equal, σ(1) for the 1-4 player≈ σ(1) for the 1-12 player and so 1-4 player has approximately the same risk than the 1-12 player for the same expected amount won. But 1-12 player would be labeled as a counter quicker than 1-4 player so 1-4 player betting pattern is preferred.

If 1-4 players unit bet size is 2.15 times the unit bet size of 1-12 player, then μ(1) and σ(1) of both players are approximately equal.
For example, if 1-12 player's unit bet size is $25 so 1-12 player ranges his bets from $25 to $300 then if 1-4 player's unit bet size is $50 (actually $53.75) so 1-4 player's bets range from $50 to $200 (actually $53.75 to $215) then μ(1) and σ(1) of both players are approximately equal. The chart below compares the two betting methods. Notice that just the unit bet size is increased, not the number of hands played. σ is measured in units and if unit size is doubled then σ is doubled. If number of hands played or number of hours played (assuming constant number of hands played per hour) doubled then σ would increase by SQRT(2).

Comparison of Betting Schedules	1 to 12 spread	1 to 4 spread	1 to 4 with 115% increase in unit bet size
Player Advantage	2.02%	2.08%	2.08%
μ(1) = Expected Units Won per hour played	1.67	0.78	1.67
σ(1) = Std Dev per hour played	23.9	11.0	23.7
σ(1) / μ(1)	14.3	14.2	14.2

Distribution of First Time Ruin
for Risk of Ruins of 2.5%, 10% and 20%

2.5% risk of ruin			
Ruin occurs at "1" of random numbers between 1 and 40			
Trip #	Randbetween (1,40)	Ruin occurs on Trip #	Ruin first occurs on Trip #
1	21		**16**
2	3		
3	14		
4	26		
5	34		
6	31		
7	22		
8	27		
9	2		
10	22		
11	3		
12	25		
13	7		
14	18		
15	37		
16	1	16	
17	27		
18	29		
19	36		
20	29		
21	26		
22	24		
23	5		
24	1	24	
25	14		
26	31		
27	37		
28	26		
29	8		
30	37		
31	36		
32	9		
33	27		
34	38		
35	27		
36	10		
37	25		
38	32		
39	18		
40	8		

2.5% risk of ruin	
Simulation #	Ruin first occurs on Trip #
1	9
2	184
3	7
4	37
…	…

Count how often multiple values occur by using a PivotTable report

You can use a PivotTable report to display totals and to count the occurrences of unique values.

Select the column that contains the data. Make sure that the column has a column heading.
On the Insert tab, in the Tables group, click PivotTable.
The Create PivotTable dialog box is displayed.

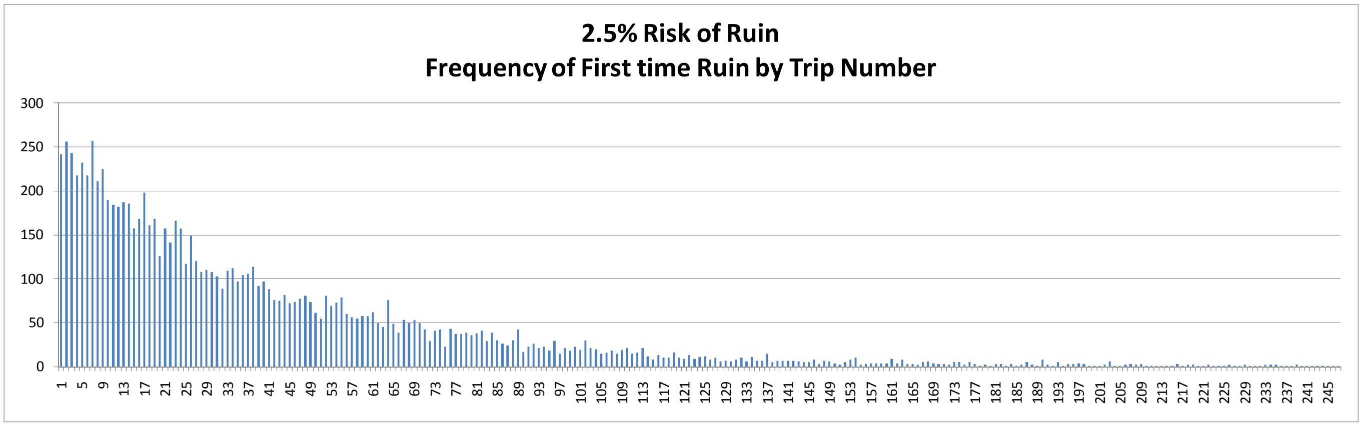
Click Select a table or range.
Place the PivotTable report in a new worksheet starting at cell A1 by clicking New Worksheet.
Click OK.
An empty PivotTable report is added to the location that you specified with the PivotTable field list displayed.

In the field section at the top of the PivotTable field list, click and hold the field name, and then drag the field to the Row Labels box in the layout section at the bottom of the PivotTable field list.

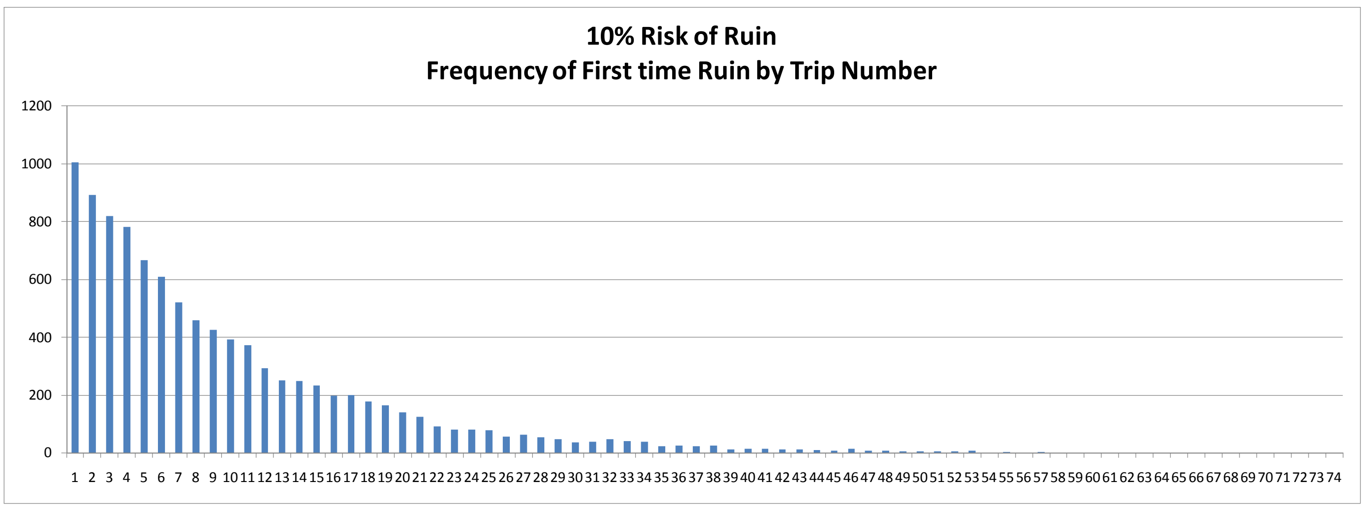
In the field section at the top of the PivotTable field list, click and hold the same field name, and then drag the again to the Values box in the layout section at the bottom of the PivotTable Field List.

Note If your data contains numbers, the PivotTable report totals the entries instead of counting them. To chan the Sum summary function to the Count summary function, select a cell in that column, and then on the Option the Active Field group, click Field Settings, click the Summarize by tab, click Count, and then click OK

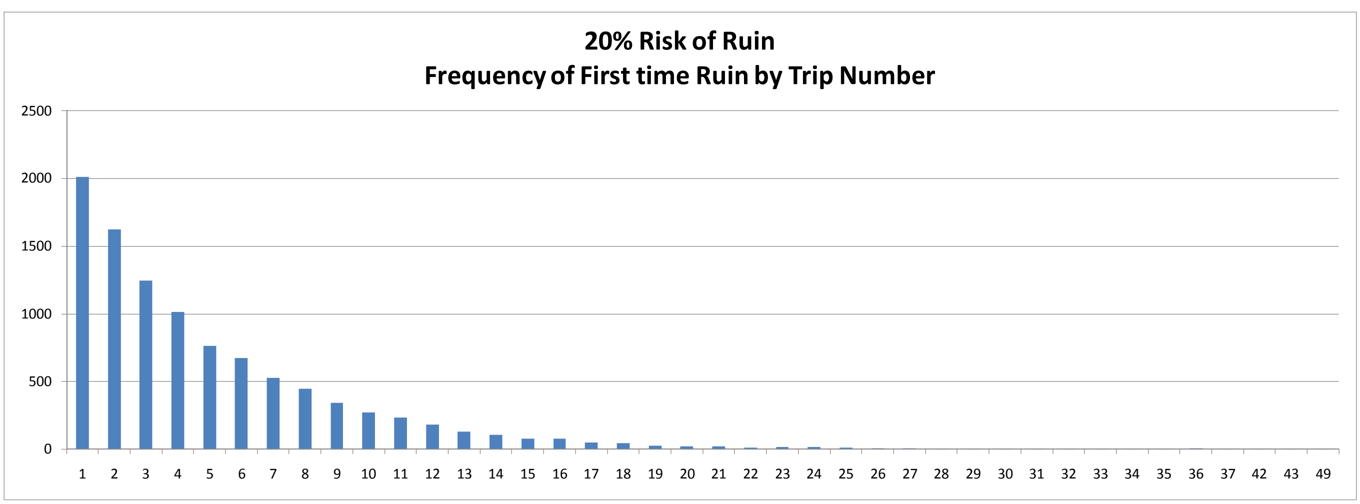
Distribution of First Time Ruin
for Risk of Ruins of 2.5%, 10% and 20%



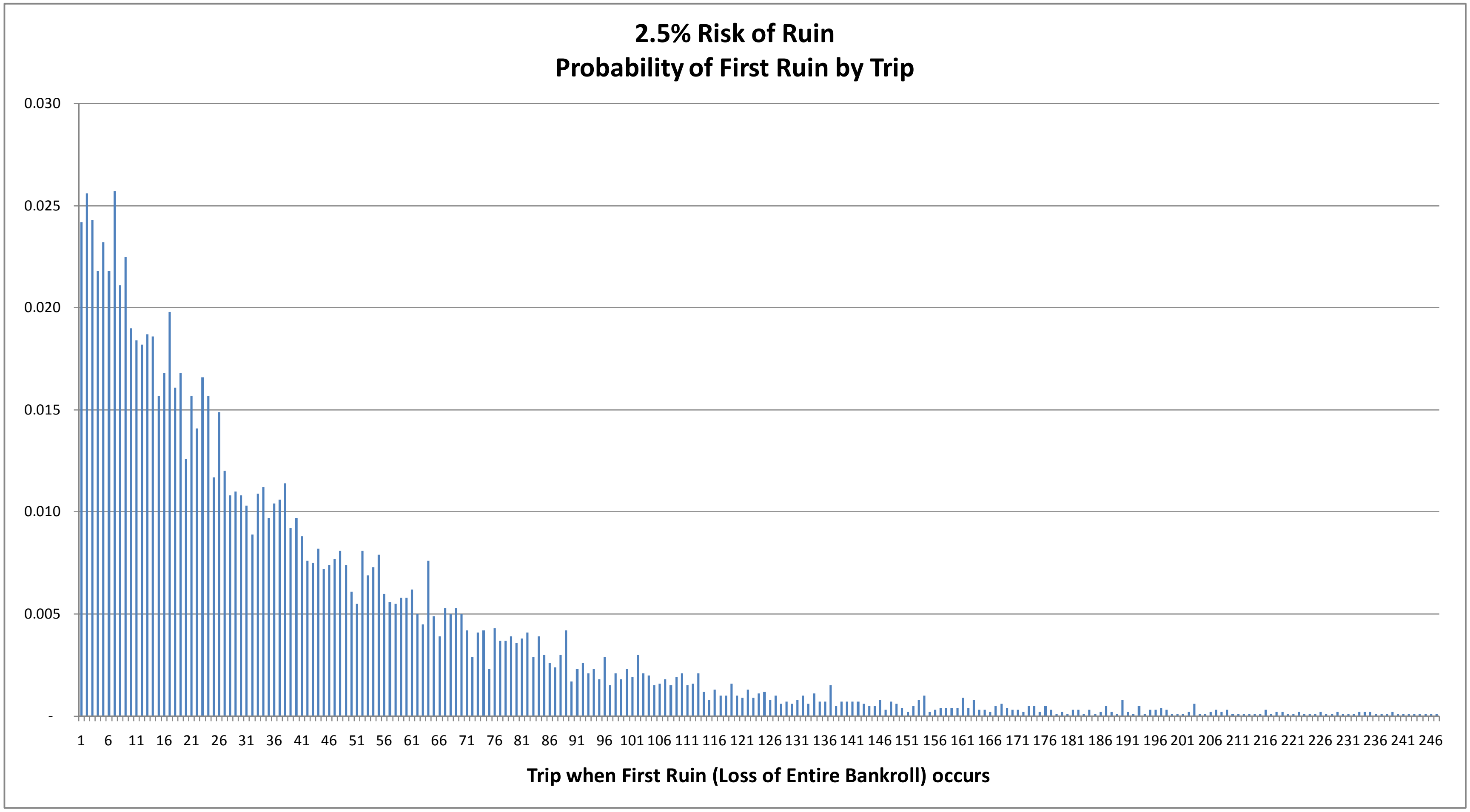
10,000 Trials Mean = 40.18 (should be 40) Median ≈ 27
With a 2.5% risk of ruin, on average, the entire bankroll will be lost once every 40 trips (mean)
The median number of trips when the entire bankroll is first lost is 26 or 27. Player is likely to first lose his entire bankroll around the 26th or 27th trip.



10,000 Trials Mean = 9.89 (should be 10) Median ≈ 7
With a 10% risk of ruin, on average, the entire bankroll will be lost once every 10 trips (mean)
The median number of trips when the entire bankroll is first lost is 6 or 7. Player is likely to first lose his entire bankroll around the 6th or 7th trip.



10,000 Trials Mean = 5.01 (should be 5) Median ≈ 3
With a 20% risk of ruin, on average, the entire bankroll will be lost once every 5 trips (mean)
The median number of trips when the entire bankroll is first lost is 3 or 4. Player is likely to first lose his entire bankroll around the 3rd or 4th trip.



10,000 Trials Mean = 40.18 (should be 40) Median ≈ 27

With a 2.5% risk of ruin, on average, the entire bankroll will be lost once every 40 trips (mean)

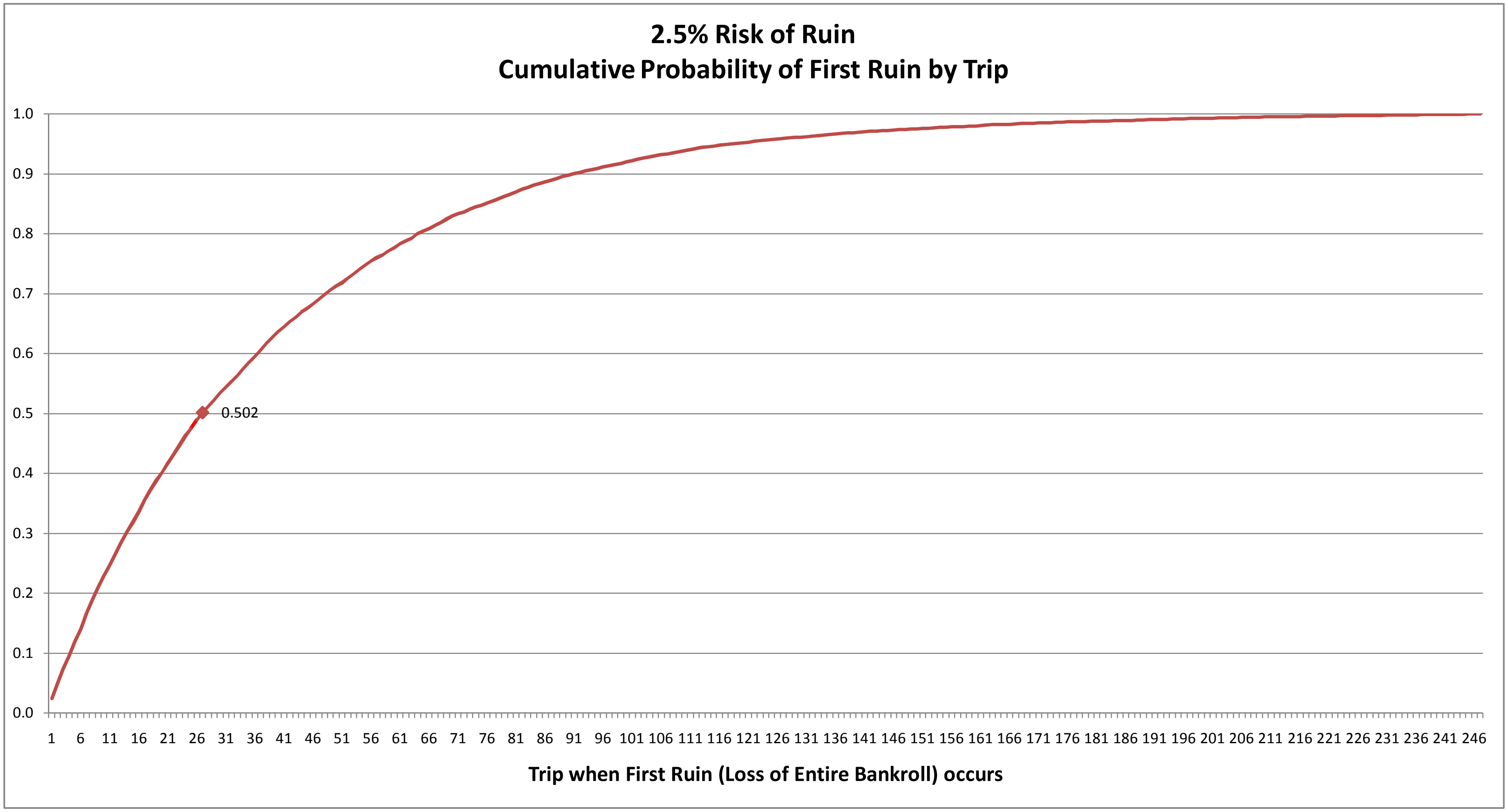
The median number of trips when the entire bankroll is first lost is ≈ 27. Player is likely to first lose his entire bankroll around the 27th trip.

Note:

This PDF (Probability Density Function) was constructed through the simulation of 10,000 trials. This PDF can also constructed by direct calculation.

Let X = trip number when first ruin (loss of entire bankroll) occurs and f(x) = P(X = x) = probability that first ruin occurs at trip number "x".

Then for a 2.5% risk of ruin, f(x) = (probability of no ruin for the fist "x-1" trips)*(probability of ruin in the "x" trip) = {(0.975)^(x-1)} * (0.025)



10,000 Trials Mean = 40.18 (should be 40) Median ≈ 27

With a 2.5% risk of ruin, on average, the entire bankroll will be lost once every 40 trips (mean)

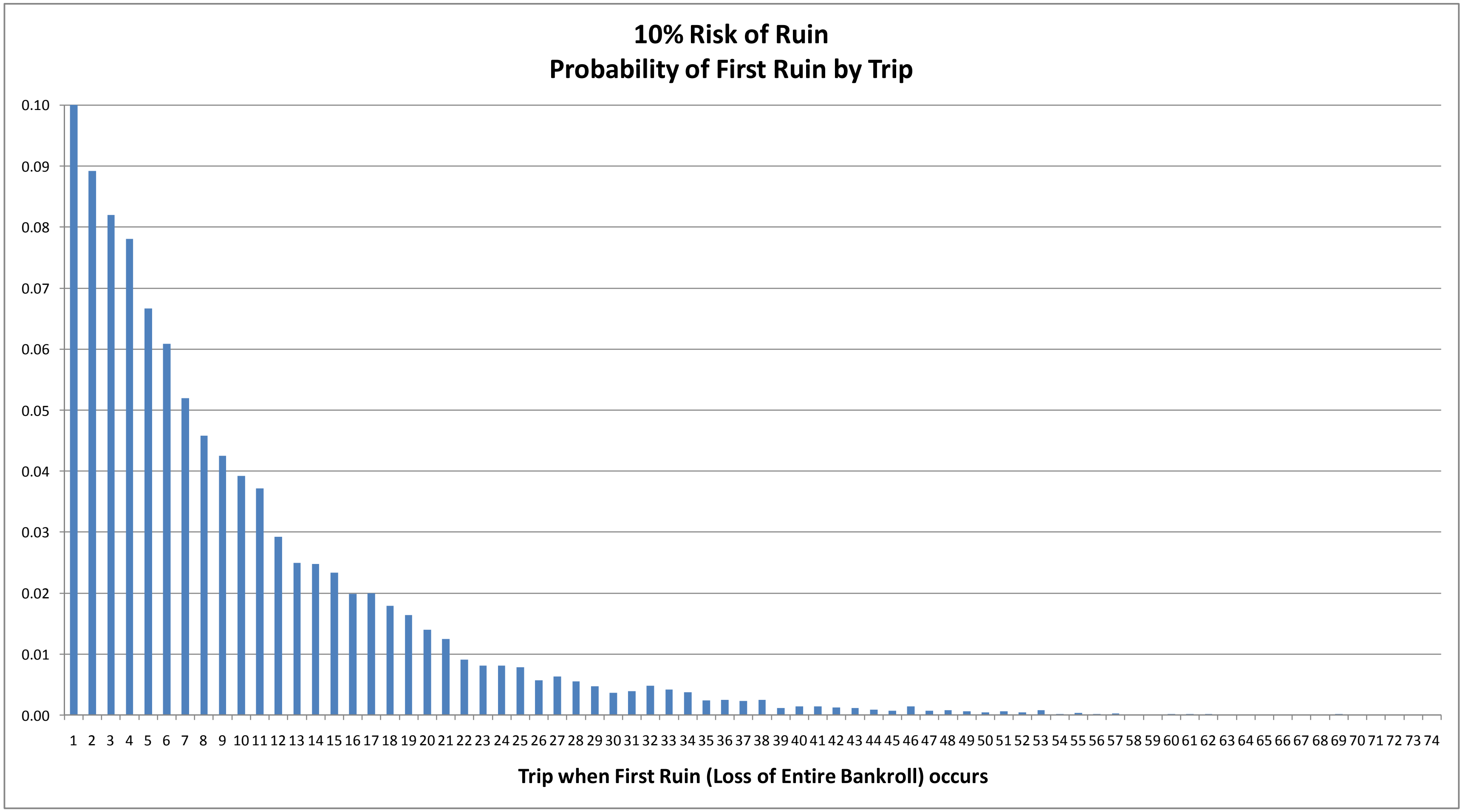
The median number of trips when the entire bankroll is first lost is ≈ 27. Player is likely to first lose his entire bankroll around the 27th trip.

Note:

This CDF (Cumulative Distribution Function) is the sum of the individual probabilities up to and including the value of interest.

Let X = trip number when first ruin (loss of entire bankroll) occurs, f(x) is PDF defined above and F(x) is CDF so F(x) = P(X <= x) = probability that first ruin occurs on or before the "x" the trip.

Then F(x) = P(X <= x) = Sum (f(x)) where x varies from -∞ to "x". In this case, f(x) is defined only for x >= 1, so F(x) = Sum(f(x)) from 1 to "x" for x >= 1.



10,000 Trials   Mean = 9.89 (should be 10)   Median ≈ 7

With a 10% risk of ruin, on average, the entire bankroll will be lost once every 10 trips (mean)

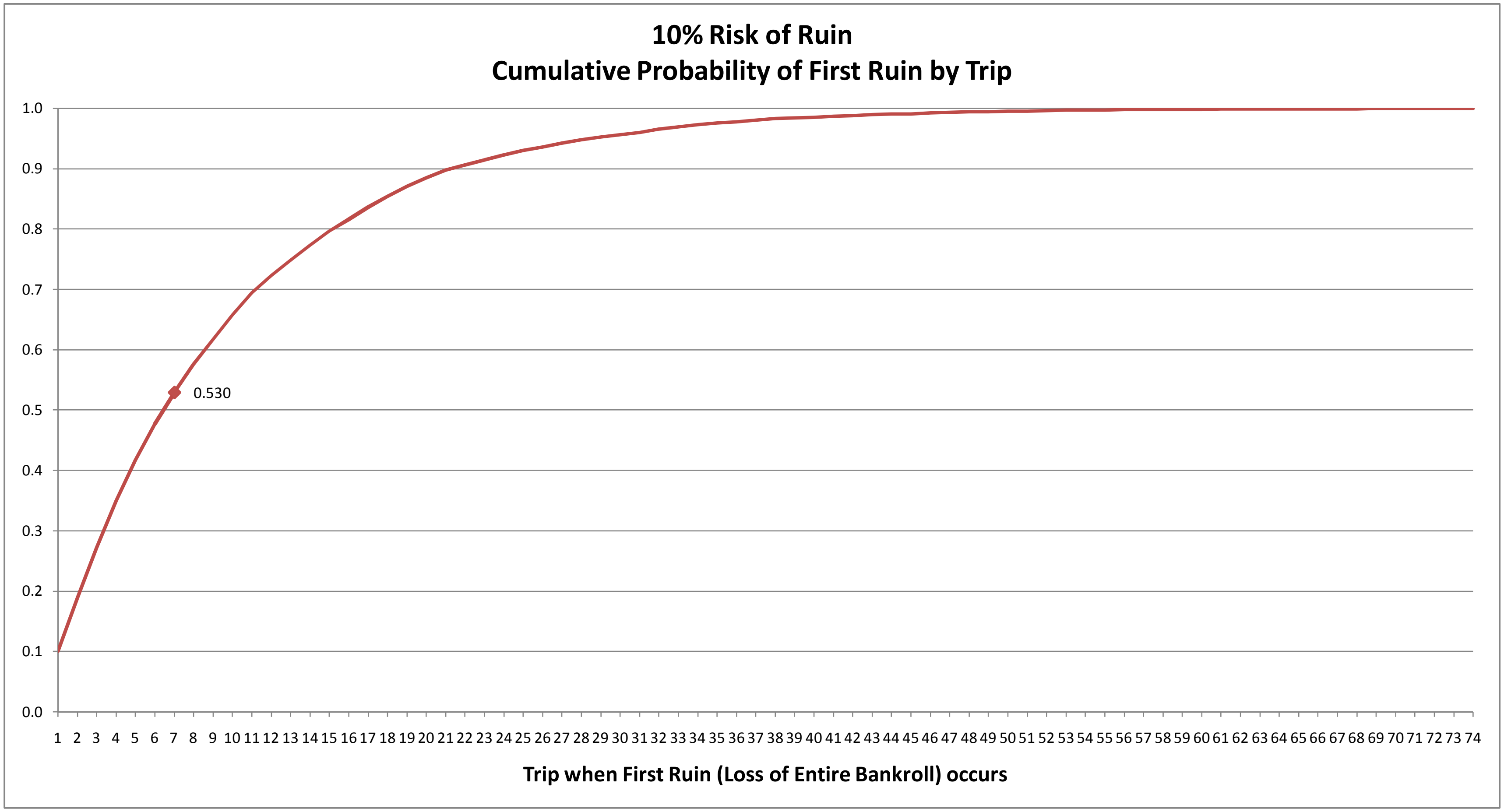
The median number of trips when the entire bankroll is first lost is ≈ 7.   Player is likely to first lose his entire bankroll around the 7th trip.

Note:

This PDF (Probability Density Function) was constructed through the simulation of 10,000 trials. This PDF can also constructed by direct calculation.

Let X = trip number when first ruin (loss of entire bankroll) occurs and f(x) = P(X = x) = probability that first ruin occurs at trip number "x".

Then for a 10% risk of ruin, f(x) = (probability of no ruin for the fist "x-1" trips)*(probability of ruin in the "x" trip) = {(0.9)^(x-1)} * (0.1)



10,000 Trials Mean = 9.89 (should be 10) Median ≈ 7

With a 10% risk of ruin, on average, the entire bankroll will be lost once every 10 trips (mean)

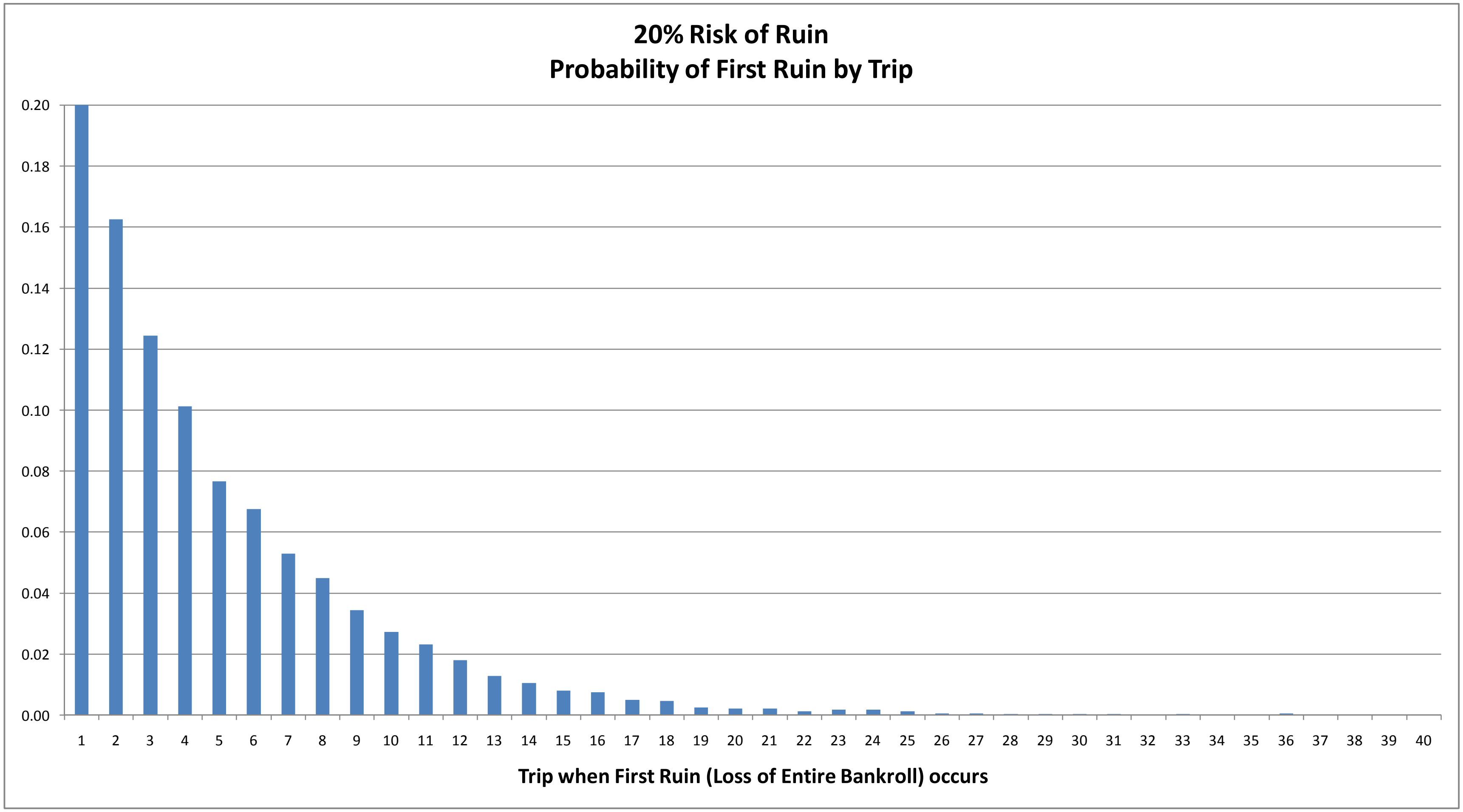
The median number of trips when the entire bankroll is first lost is ≈ 7. Player is likely to first lose his entire bankroll around the 7th trip.

Note:

This CDF (Cumulative Distribution Function) is the sum of the individual probabilities up to and including the value of interest.

Let X = trip number when first ruin (loss of entire bankroll) occurs, f(x) is PDF defined above and F(x) is CDF so F(x) = P(X <= x) = probability that first ruin occurs on or before the "x" the trip.

Then F(x) = P(X <= x) = Sum (f(x)) where x varies from -∞ to "x". In this case, f(x) is defined only for x >= 1, so F(x) = Sum(f(x)) from 1 to "x" for x >= 1.



10,000 Trials Mean = 5.01 (should be 5) Median ≈ 3

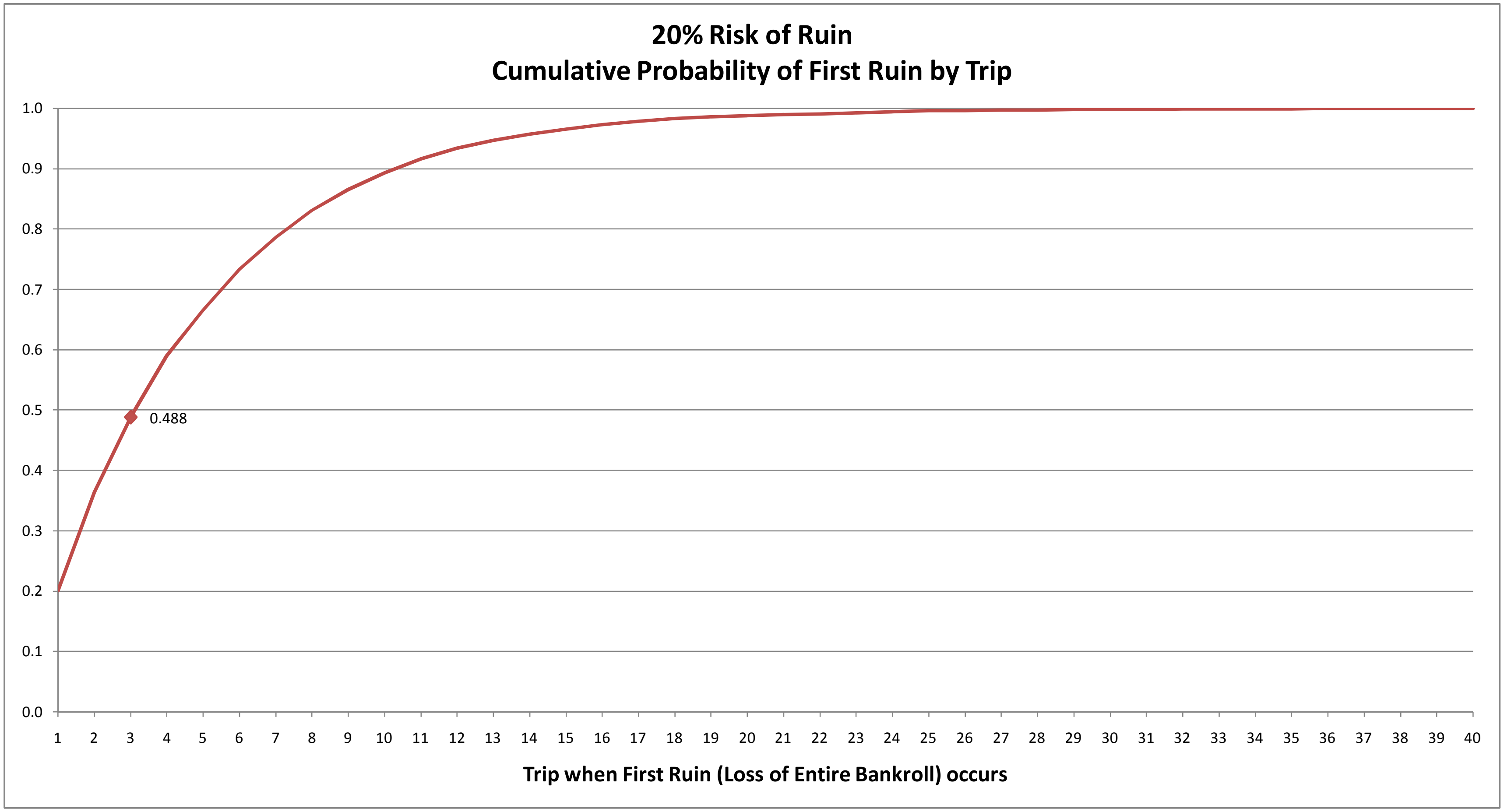
With a 20% risk of ruin, on average, the entire bankroll will be lost once every 5 trips (mean)

The median number of trips when the entire bankroll is first lost is ≈ 3. Player is likely to first lose his entire bankroll around the 3rd trip.

This PDF (Probability Density Function) was constructed through the simulation of 10,000 trials. This PDF can also constructed by direct calculation.

Let X = trip number when first ruin (loss of entire bankroll) occurs and f(x) = P(X = x) = probability that first ruin occurs at trip number "x".

Then for a 20% risk of ruin, f(x) = (probability of no ruin for the fist "x-1" trips)*(probability of ruin in the "x" trip) = {(0.8)^(x-1)} * (0.2)



10,000 Trials Mean = 5.01 (should be 5) Median ≈ 3

With a 20% risk of ruin, on average, the entire bankroll will be lost once every 5 trips (mean)

The median number of trips when the entire bankroll is first lost is ≈ 3. Player is likely to first lose his entire bankroll around the 3rd trip.

<u>Note:</u>

This CDF (Cumulative Distribution Function) is the sum of the individual probabilities up to and including the value of interest.

Let X = trip number when first ruin (loss of entire bankroll) occurs, f(x) is PDF defined above and F(x) is CDF so F(x) = P(X <= x) = probability that first ruin occurs on or before the "x" the trip.

Then F(x) = P(X <= x) = Sum (f(x)) where x varies from -∞ to "x". In this case, f(x) is defined only for x >= 1, so F(x) = Sum(f(x)) from 1 to "x" for x >= 1.

Theoretical calculation of mean and median of Trip number when First Ruin occurs

Let X = trip number when first ruin (loss of entire bankroll) occurs and f(x) = P(X = x) = probability that first ruin occurs at trip number "x".
If r = risk of ruin, then f(x) = (probability of no ruin for the fist "x-1" trips)*(probability of ruin in the "x" trip) = {(1-r)^(x-1)} * r where x >= 1.

f(x) = {(1-r)^(x-1)} * r where x >= 1.

Then F(x) = P(X <= x) = Sum (f(x)) where x varies from -∞ to "x". In this case, f(x) is defined only for x >= 1.

F(x) = Sum(f(x)) from 1 to "x" for x >= 1.

Mean(X) = E(X) = Sum (x * f(x)) from x = 1 to ∞
Mean(X) = Sum (x * ((1-r)^(x-1)) * r) from x = 1 to ∞
Mean(X) = r + 2*(1-r)*r + 3*((1-r)^2)*r + 4*((1-r)^3)*r + …..
Mean(X) = r * (1 + 2*(1-r) + 3*(1-r)^2 + 4*(1-r)^3 + …..)

Let S = 1 + 2*(1-r) + 3*(1-r)^2 + 4*(1-r)^3 + …..

S	=	1 + 2*(1-r) + 3*(1-r)^2 + 4*(1-r)^3 + …..
(1-r)*S	=	(1-r) + 2*(1-r)^2 + 3*(1-r)^3 + …..
S - (1-r)*S	=	1 + (1-r) + (1-r)^2 + (1-r)^3 +
r*S	=	1 + (1-r) + (1-r)^2 + (1-r)^3 +

Let T = 1 + (1-r) + (1-r)^2 + (1-r)^3 + …..

T	=	1 + (1-r) + (1-r)^2 + (1-r)^3 + …..
(1-r)*T	=	(1-r) + (1-r)^2 + (1-r)^3 + …..
T - (1-r)*T	=	1
r*T	=	1

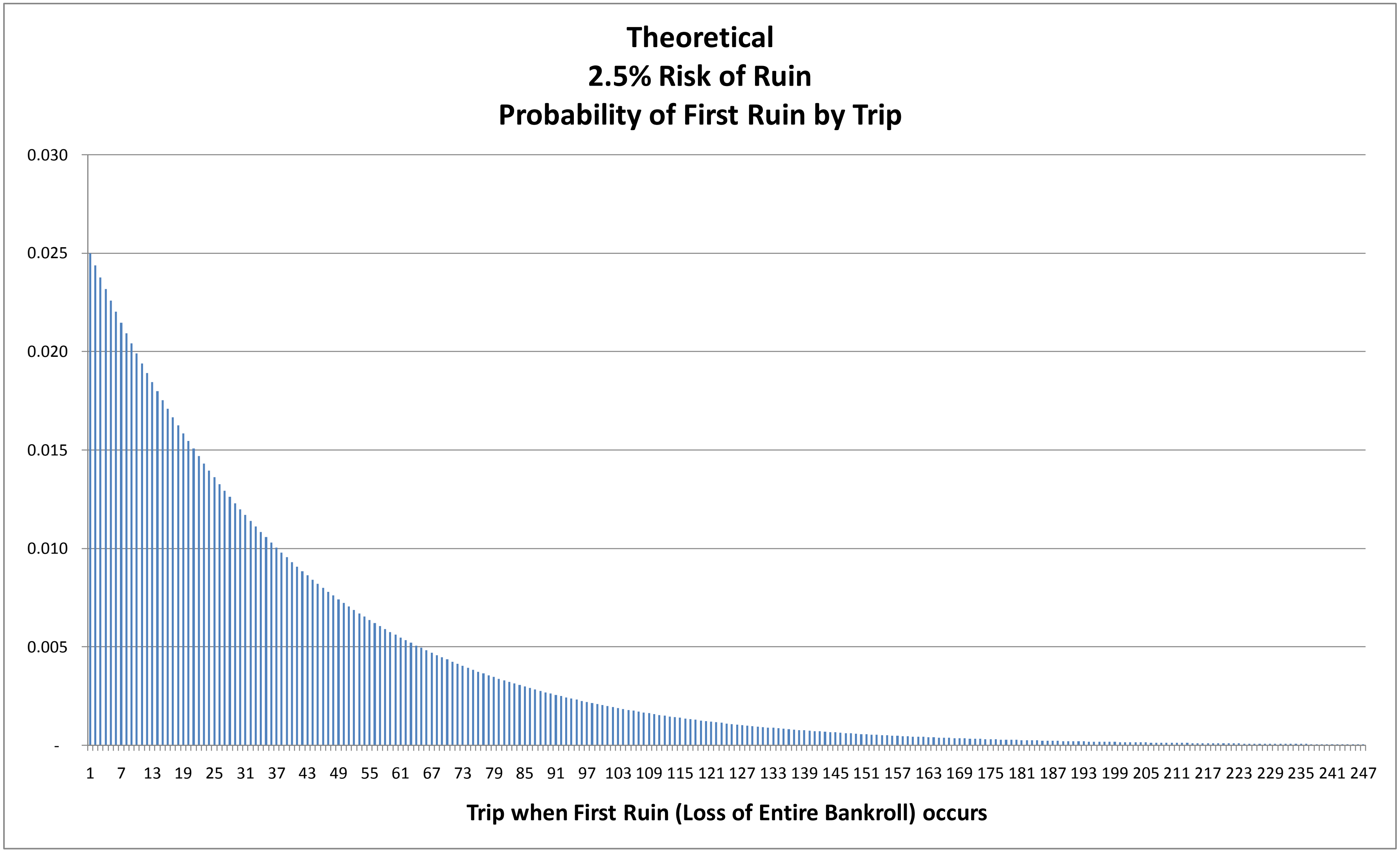
S	=	(1/r) * T	Mean(X)	=	r*S
S	=	(1/r) * (1/r)	Mean(X)	=	r*(1/r)^2
S	=	(1/r)^2	**Mean(X)**	**=**	**(1/r)**

So if risk of ruin = 2.5% then Mean(X) = (1 / 0.025) = 40. The *average* trip number when the first loss occurs = 40

If m = median value of X then F(m) = 0.500
f(1) + f(2) + f(3) + …. + f(m) = 0.500
r + (1-r)*r + ((1-r)^2)*r + …. + ((1-r)^(m - 1))*r = 0.500
r * (1 + (1-r) + ((1-r)^2) + …. + ((1-r)^(m - 1)) = 0.500
1 - (1-r)^m = 0.500 (see derivation to the right)
Median(X) = ln(0.5) / ln(1-r)

If U = 1 + v + v^2 + … v^n then U = ((1-v^(n+1)) / (1-v)
Let v = (1-r) and n = (m-1) then
U = (1 - (1-r)^m) / (1-(1-r)) = (1 - (1-r)^m) / r
r*U = 1 - (1-r)^m

So if risk of ruin = 2.5% then Median(X) = ln(0.5) / ln(0.975) ≈ 27.38. The *median* trip number when the first loss occurs = 27.
In 40 trips one loss of the total 2.5% risk of ruin bankroll is to be expected and that loss is most likely to occur on the 27th trip.



X = trip number when first ruin occurs

Median(X)	**=**	**ln(0.5) / ln(1-r)**
Mean(X)	**=**	**(1/r)**
Median(X)	**≈**	**(2/3) * Mean(X)**

	Risk of Ruin = r		
	2.5%	10%	20%
Median(X)	27.38	6.58	3.11
Mean(X)	40.00	10.00	5.00
Median / Mean	68%	66%	62%

Exhibit F1c

Sample Risk of Ruin Formula Calculation

U = win (+1,-1 only outcomes) with unit bet:
p = prob win (+1, -1 only outcomes) with "a" advantage
q = prob loss (+1, -1 only outcomes) with "a" advantage
p + q = 1.   p = P(U = 1) = f(1), q = P(U = -1) = f(-1)
E(U) = p*(+1) + q*(-1) = a (advantage)
p + (-1)*(1-p) = a,   p = (a + 1)/2
If a = 2.0% player's advantage, then p = 0.51 and q = 0.49

All Bets made at 2.0% advantage
Bets randomly distributed between one and eight

X = Amount Won, f(x) = P(X = x)

B = Amount Bet, g(b) = P(B = b)

				f(+b)		f(-b)
b	g(b)	b*g(b)	p	p*g(b)	q	q*g(b)
1	0.125	0.125	0.510	0.06375	0.490	0.06125
2	0.125	0.250	0.510	0.06375	0.490	0.06125
3	0.125	0.375	0.510	0.06375	0.490	0.06125
4	0.125	0.500	0.510	0.06375	0.490	0.06125
5	0.125	0.625	0.510	0.06375	0.490	0.06125
6	0.125	0.750	0.510	0.06375	0.490	0.06125
7	0.125	0.875	0.510	0.06375	0.490	0.06125
8	0.125	1.000	0.510	0.06375	0.490	0.06125
Avg Bet	1.000	4.500	n/a	0.51000	n/a	0.49000

X = Amount Won, f(x) = P(X = x)
μ(1) = expected win, 1 trial, σ(1) = std dev, 1 trial, % adv = μ(1) / avg bet

x	f(x)	x*f(x)	x - μ	(x - μ)^2*f(x)	x^2*f(x)
8	0.06375	0.51000	7.91	3.98872	4.08000
7	0.06375	0.44625	6.91	3.04394	3.12375
6	0.06375	0.38250	5.91	2.22667	2.29500
5	0.06375	0.31875	4.91	1.53689	1.59375
4	0.06375	0.25500	3.91	0.97462	1.02000
3	0.06375	0.19125	2.91	0.53984	0.57375
2	0.06375	0.12750	1.91	0.23257	0.25500
1	0.06375	0.06375	0.91	0.05279	0.06375
-1	0.06125	-0.06125	-1.09	0.07277	0.06125
-2	0.06125	-0.12250	-2.09	0.26755	0.24500
-3	0.06125	-0.18375	-3.09	0.58482	0.55125
-4	0.06125	-0.24500	-4.09	1.02460	0.98000
-5	0.06125	-0.30625	-5.09	1.58687	1.53125
-6	0.06125	-0.36750	-6.09	2.27165	2.20500
-7	0.06125	-0.42875	-7.09	3.07892	3.00125
-8	0.06125	-0.49000	-8.09	4.00870	3.92000
μ(1)	1.00000	0.09000	var(1)	25.49190	25.50000
	Average Bet	4.5000	σ(1)	5.04895	E(X^2)
	Advantage	2.0%	Variance = E(X- μ)^2 = E(X^2) - μ^2		
	μ = E(X) = 0.09		var = E(X^2) - μ^2 = 25.5 - 0.09^2 = 25.4919		

x >= 1:   f(x) = P(bet ABS(x) units and then won) = g(x)*p
x <= -1: f(x) = P(bet ABS(x) units and then lost) = g(-x)*q
E(X^2) = Sum((x^2)*f(x))
= (1^2)*g(1)*p + (2^2)*g(2)*p + (3^2)*g(3)*p + … + (8^2)*g(8)*p +
   ((-1)^2)*g(1)*q + ((-2)^2)*g(2)*q + ((-3)^2)*g(3)*q + … + ((-8)^2)*g(8)*q
= (1^2)*g(1) + (2^2)*g(2) + (3^2)*g(3)+ … + (8^2)*g(8)   since (p + q) = 1

Sample Risk of Ruin Formula Calculation

μ(1) = expected win, 1 trial, σ(1) = std dev, 1 trial, % adv = μ(1) / avg bet

Number Trials		1	Calculation of μ(1), σ(1) and % advantage			
(1)	(2)	(3)	(4)	(5) = (1) * (4)	(6) = (5) * (3)	(7)
Units Bet	trial %	pa(t)	# trials played	Amount Bet	Expected Win	= (4)*(1)^2
1.00	12.5%	2.00%	0.125	0.125	0.003	0.125
2.00	12.5%	2.00%	0.125	0.250	0.005	0.500
3.00	12.5%	2.00%	0.125	0.375	0.008	1.125
4.00	12.5%	2.00%	0.125	0.500	0.010	2.000
5.00	12.5%	2.00%	0.125	0.625	0.013	3.125
6.00	12.5%	2.00%	0.125	0.750	0.015	4.500
7.00	12.5%	2.00%	0.125	0.875	0.018	6.125
8.00	12.5%	2.00%	0.125	1.000	0.020	8.000
	100.0%	n/a	1.000	4.500	**0.090**	25.500
	% adv = 0.09 / 4.5 =		2.00%	variance =	25.5 - 0.09^2 =	25.492
		μ(1)	0.09000		σ(1)	5.04895

E(X^2) = Sum((x^2)*f(x)) = (1^2)*g(1) + (2^2)*g(2) + (3^2)*g(3)+ … + (8^2)*g(8) = Tot(7) = 25.5

μ(200) = expected win, 200 trials, σ(200) = std dev, 200 trials, % adv = μ(1) / avg bet

Number Trials		200	Calculation of μ(200), σ(200) and % advantage			
(1)	(2)	(3)	(4)	(5) = (1) * (4)	(6) = (5) * (3)	(7)
Units Bet	trial %	pa(t)	# trials played	Amount Bet	Expected Win	= (4)*(1)^2
1.00	12.5%	2.00%	25.0	25.0	0.5	25.0
2.00	12.5%	2.00%	25.0	50.0	1.0	100.0
3.00	12.5%	2.00%	25.0	75.0	1.5	225.0
4.00	12.5%	2.00%	25.0	100.0	2.0	400.0
5.00	12.5%	2.00%	25.0	125.0	2.5	625.0
6.00	12.5%	2.00%	25.0	150.0	3.0	900.0
7.00	12.5%	2.00%	25.0	175.0	3.5	1,225.0
8.00	12.5%	2.00%	25.0	200.0	4.0	1,600.0
	100.0%	n/a	200.0	900.0	**18.0**	5,100.0
	% adv = 18 / 900 =		2.00%	variance =	5100 - 18^2 =	4,776.0
		μ(200)	18.0		σ(200)	69.1

In this example, σ(n) formula is only approximately true:

σ(n) ≈ SQRT(n)*σ(1)   σ(200) ≈ SQRT(200)*σ(1) = SQRT(200) * 5.04895 = 71.4

Calculation of Risk of Ruin:			
trials	μ(n) = n*μ(1)	μ(200)	18.0
200	σ(n) ≈ SQRT(n)*σ(1)	σ(200)	69.1 (exact)
	Bankroll	B	80

R = N((-B - μ)/σ) + EXP((-2*μ*B)/σ^2) * N((-B + μ)/σ) N(x) = area to the left of "x" for the standard

R = Risk of Ruin, μ = Exp. Win, σ = Std Dev, B = Bank NORMDIST with mean 0 and std dev 1.

(1)	N((-B - μ)/σ)	0.078
(2)	EXP((-2*μ*B)/σ^2)	0.547
(3)	N((-B + μ)/σ)	0.185
	R = (1) + (2)*(3)	**17.9%**

Sample Risk of Ruin Simulation

80 unit bankroll, 200 trials

Trial #	(1) Randbetween (1,1000)	(2) Outcome: If ((1) <= 510,1,-1)	(3) Bet: Randbetween (1,8)	(4) Amount Won / (Lost) (3)*(2)	(5) Bankroll (B) = B:prev + (4)
					80
1	906	-1	7	-7	73
2	108	1	3	3	76
3	918	-1	2	-2	74
4	76	1	6	6	80
5	653	-1	3	-3	77
6	488	1	3	3	80
7	430	1	3	3	83
8	733	-1	5	-5	78
9	670	-1	6	-6	72
10	882	-1	4	-4	68
11	355	1	4	4	72
12	585	-1	8	-8	64
13	341	1	6	6	70
14	465	1	3	3	73
15	99	1	6	6	79
16	80	1	6	6	85
17	138	1	6	6	91
18	25	1	4	4	95
19	992	-1	7	-7	88
20	579	-1	5	-5	83
21	720	-1	4	-4	79
22	252	1	1	1	80
23	86	1	4	4	84
24	752	-1	7	-7	77
25	101	1	6	6	83
26	783	-1	3	-3	80
27	53	1	5	5	85
28	494	1	5	5	90
29	471	1	4	4	94
30	577	-1	7	-7	87
31	857	-1	8	-8	79
32	273	1	5	5	84
33	150	1	8	8	92
34	739	-1	7	-7	85
35	436	1	4	4	89
36	710	-1	5	-5	84
37	61	1	5	5	89
38	215	1	5	5	94
39	535	-1	8	-8	86
40	425	1	1	1	87
41	694	-1	6	-6	81
42	557	-1	4	-4	77
43	202	1	3	3	80
44	408	1	3	3	83
45	11	1	5	5	88

Sample Risk of Ruin Simulation

80 unit bankroll, 200 trials

Trial #	(1) Randbetween (1,1000)	(2) Outcome: If ((1) <= 510,1,-1)	(3) Bet: Randbetween (1,8)	(4) Amount Won / (Lost) (3)*(2)	(5) Bankroll (B) = B:prev + (4)
46	185	1	3	3	91
47	940	-1	7	-7	84
48	398	1	3	3	87
49	806	-1	6	-6	81
50	514	-1	2	-2	79
51	599	-1	1	-1	78
52	675	-1	6	-6	72
53	846	-1	8	-8	64
54	824	-1	4	-4	60
55	310	1	6	6	66
56	819	-1	3	-3	63
57	794	-1	5	-5	58
58	745	-1	4	-4	54
59	261	1	5	5	59
60	515	-1	8	-8	51
61	69	1	1	1	52
62	851	-1	1	-1	51
63	365	1	3	3	54
64	389	1	2	2	56
65	992	-1	1	-1	55
66	20	1	1	1	56
67	123	1	5	5	61
68	215	1	8	8	69
69	310	1	4	4	73
70	819	-1	6	-6	67
71	158	1	1	1	68
72	411	1	8	8	76
73	270	1	4	4	80
74	25	1	1	1	81
75	934	-1	8	-8	73
76	146	1	5	5	78
77	202	1	3	3	81
78	825	-1	4	-4	77
79	436	1	2	2	79
80	519	-1	5	-5	74
81	480	1	5	5	79
82	945	-1	2	-2	77
83	520	-1	2	-2	75
84	436	1	3	3	78
85	194	1	6	6	84
86	362	1	6	6	90
87	902	-1	3	-3	87
88	683	-1	2	-2	85
89	523	-1	8	-8	77
90	100	1	6	6	83

Sample Risk of Ruin Simulation

80 unit bankroll, 200 trials

Trial #	(1) Randbetween (1,1000)	(2) Outcome: If ((1) <= 510,1,-1)	(3) Bet: Randbetween (1,8)	(4) Amount Won / (Lost) (3)*(2)	(5) Bankroll (B) = B:prev + (4)
91	449	1	2	2	85
92	382	1	7	7	92
93	874	-1	7	-7	85
94	893	-1	3	-3	82
95	105	1	5	5	87
96	377	1	6	6	93
97	562	-1	7	-7	86
98	603	-1	7	-7	79
99	897	-1	4	-4	75
100	403	1	8	8	83
101	946	-1	5	-5	78
102	7	1	4	4	82
103	308	1	5	5	87
104	186	1	4	4	91
105	779	-1	8	-8	83
106	556	-1	7	-7	76
107	769	-1	4	-4	72
108	290	1	5	5	77
109	740	-1	1	-1	76
110	704	-1	7	-7	69
111	913	-1	1	-1	68
112	142	1	1	1	69
113	657	-1	7	-7	62
114	265	1	3	3	65
115	800	-1	3	-3	62
116	307	1	2	2	64
117	141	1	4	4	68
118	669	-1	5	-5	63
119	578	-1	1	-1	62
120	873	-1	2	-2	60
121	465	1	1	1	61
122	720	-1	7	-7	54
123	718	-1	3	-3	51
124	567	-1	7	-7	44
125	967	-1	5	-5	39
126	514	-1	4	-4	35
127	137	1	7	7	42
128	288	1	3	3	45
129	208	1	8	8	53
130	983	-1	2	-2	51
131	477	1	5	5	56
132	994	-1	5	-5	51
133	241	1	5	5	56
134	23	1	5	5	61
135	612	-1	1	-1	60

Sample Risk of Ruin Simulation
80 unit bankroll, 200 trials

Trial #	(1) Randbetween (1,1000)	(2) Outcome: If ((1) <= 510,1,-1)	(3) Bet: Randbetween (1,8)	(4) Amount Won / (Lost) (3)*(2)	(5) Bankroll (B) = B:prev + (4)
136	485	1	3	3	63
137	868	-1	6	-6	57
138	531	-1	5	-5	52
139	40	1	6	6	58
140	198	1	6	6	64
141	896	-1	5	-5	59
142	3	1	8	8	67
143	737	-1	1	-1	66
144	556	-1	5	-5	61
145	337	1	4	4	65
146	358	1	2	2	67
147	840	-1	2	-2	65
148	249	1	5	5	70
149	756	-1	4	-4	66
150	192	1	1	1	67
151	713	-1	7	-7	60
152	826	-1	2	-2	58
153	409	1	8	8	66
154	262	1	4	4	70
155	446	1	2	2	72
156	390	1	5	5	77
157	998	-1	1	-1	76
158	813	-1	8	-8	68
159	790	-1	4	-4	64
160	680	-1	8	-8	56
161	317	1	7	7	63
162	279	1	2	2	65
163	624	-1	5	-5	60
164	820	-1	4	-4	56
165	786	-1	3	-3	53
166	377	1	8	8	61
167	121	1	1	1	62
168	437	1	4	4	66
169	246	1	1	1	67
170	102	1	5	5	72
171	198	1	6	6	78
172	32	1	2	2	80
173	118	1	1	1	81
174	379	1	8	8	89
175	862	-1	8	-8	81
176	634	-1	7	-7	74
177	792	-1	2	-2	72
178	345	1	4	4	76
179	332	1	4	4	80
180	198	1	6	6	86

Sample Risk of Ruin Simulation
80 unit bankroll, 200 trials

Trial #	(1) Randbetween (1,1000)	(2) Outcome: If ((1) <= 510,1,-1)	(3) Bet: Randbetween (1,8)	(4) Amount Won / (Lost) (3)*(2)	(5) Bankroll (B) = B:prev + (4)
181	543	-1	4	-4	82
182	487	1	5	5	87
183	394	1	8	8	95
184	769	-1	6	-6	89
185	306	1	1	1	90
186	346	1	5	5	95
187	504	1	5	5	100
188	363	1	4	4	104
189	255	1	7	7	111
190	517	-1	4	-4	107
191	360	1	7	7	114
192	673	-1	8	-8	106
193	620	-1	5	-5	101
194	188	1	6	6	107
195	677	-1	5	-5	102
196	501	1	8	8	110
197	270	1	5	5	115
198	38	1	3	3	118
199	855	-1	5	-5	113
200	973	-1	7	-7	106
				minimum	35
				Ruin if minimum <=	0

Ruin if Bankroll (column (5)) is zero or negative at some point during the 200 trials, i.e. ruin if minimum of column (5) is less than or equal to zero.

Results of 20,000 simulations of 200 trials per simulation:		
# times ruin (minimum col(5) <= 0):	3,644	(1)
# simulations	20,000	(2)
Probability of Ruin	18.2%	(1) / (2)

Risk of Ruin from Formula **17.9%**
Risk of Ruin from Simulation **18.2%**

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	$(X - \mu)$	$(X - \mu)^2$	$(X - \mu)^3$	$(X - \mu)^4$	F(x)
-17.5	1	0.000000	(17.4995)	306.23	(5,359)	93,779	0.000000
-17.4	-	-	(17.3995)	302.74	(5,268)	91,653	0.000000
-17.3	-	-	(17.2995)	299.27	(5,177)	89,564	0.000000
-17.2	-	-	(17.1995)	295.82	(5,088)	87,511	0.000000
-17.1	-	-	(17.0995)	292.39	(5,000)	85,494	0.000000
-17.0	-	-	(16.9995)	288.98	(4,913)	83,511	0.000000
-16.9	-	-	(16.8995)	285.59	(4,826)	81,564	0.000000
-16.8	-	-	(16.7995)	282.22	(4,741)	79,650	0.000000
-16.7	3	0.000001	(16.6995)	278.87	(4,657)	77,770	0.000002
-16.6	-	-	(16.5995)	275.54	(4,574)	75,924	0.000002
-16.5	-	-	(16.4995)	272.23	(4,492)	74,111	0.000002
-16.4	2	0.000001	(16.3995)	268.94	(4,411)	72,331	0.000003
-16.3	-	-	(16.2995)	265.67	(4,330)	70,583	0.000003
-16.2	-	-	(16.1995)	262.42	(4,251)	68,866	0.000003
-16.1	-	-	(16.0995)	259.19	(4,173)	67,182	0.000003
-16.0	2	0.000001	(15.9995)	255.98	(4,096)	65,528	0.000003
-15.9	1	0.000000	(15.8995)	252.79	(4,019)	63,905	0.000004
-15.8	1	0.000000	(15.7995)	249.62	(3,944)	62,312	0.000004
-15.7	-	-	(15.6995)	246.47	(3,870)	60,750	0.000004
-15.6	3	0.000001	(15.5995)	243.34	(3,796)	59,217	0.000006
-15.5	1	0.000000	(15.4995)	240.23	(3,724)	57,713	0.000006
-15.4	-	-	(15.3995)	237.14	(3,652)	56,238	0.000006
-15.3	6	0.000003	(15.2995)	234.07	(3,581)	54,791	0.000009
-15.2	1	0.000000	(15.1995)	231.03	(3,511)	53,373	0.000009
-15.1	5	0.000002	(15.0995)	228.00	(3,443)	51,982	0.000011
-15.0	2	0.000001	(14.9995)	224.99	(3,375)	50,618	0.000012
-14.9	3	0.000001	(14.8995)	222.00	(3,308)	49,282	0.000013
-14.8	2	0.000001	(14.7995)	219.03	(3,241)	47,972	0.000014
-14.7	6	0.000003	(14.6995)	216.08	(3,176)	46,689	0.000017
-14.6	2	0.000001	(14.5995)	213.15	(3,112)	45,431	0.000018
-14.5	15	0.000006	(14.4995)	210.24	(3,048)	44,199	0.000024
-14.4	2	0.000001	(14.3995)	207.35	(2,986)	42,992	0.000025
-14.3	11	0.000005	(14.2995)	204.48	(2,924)	41,810	0.000029
-14.2	3	0.000001	(14.1995)	201.63	(2,863)	40,653	0.000031
-14.1	2	0.000001	(14.0995)	198.80	(2,803)	39,520	0.000032

Hi-Low True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	$(X - \mu)$	$(X - \mu)^2$	$(X - \mu)^3$	$(X - \mu)^4$	F(x)
-17.5	-	-	(17.4939)	306.04	(5,354)	93,658	-
-17.4	-	-	(17.3939)	302.55	(5,262)	91,535	-
-17.3	3	0.00000	(17.2939)	299.08	(5,172)	89,448	0.000001
-17.2	-	-	(17.1939)	295.63	(5,083)	87,397	0.000001
-17.1	2	0.00000	(17.0939)	292.20	(4,995)	85,382	0.000002
-17.0	2	0.00000	(16.9939)	288.79	(4,908)	83,401	0.000003
-16.9	5	0.00000	(16.8939)	285.40	(4,822)	81,455	0.000005
-16.8	-	-	(16.7939)	282.04	(4,736)	79,544	0.000005
-16.7	2	0.00000	(16.6939)	278.69	(4,652)	77,666	0.000006
-16.6	2	0.00000	(16.5939)	275.36	(4,569)	75,822	0.000007
-16.5	4	0.00000	(16.4939)	272.05	(4,487)	74,011	0.000009
-16.4	-	-	(16.3939)	268.76	(4,406)	72,232	0.000009
-16.3	2	0.00000	(16.2939)	265.49	(4,326)	70,486	0.000009
-16.2	2	0.00000	(16.1939)	262.24	(4,247)	68,771	0.000010
-16.1	1	0.00000	(16.0939)	259.01	(4,169)	67,088	0.000011
-16.0	2	0.00000	(15.9939)	255.80	(4,091)	65,436	0.000012
-15.9	1	0.00000	(15.8939)	252.62	(4,015)	63,815	0.000012
-15.8	3	0.00000	(15.7939)	249.45	(3,940)	62,224	0.000013
-15.7	-	-	(15.6939)	246.30	(3,865)	60,663	0.000013
-15.6	1	0.00000	(15.5939)	243.17	(3,792)	59,132	0.000014
-15.5	3	0.00000	(15.4939)	240.06	(3,719)	57,629	0.000015
-15.4	2	0.00000	(15.3939)	236.97	(3,648)	56,156	0.000016
-15.3	4	0.00000	(15.2939)	233.90	(3,577)	54,711	0.000018
-15.2	-	-	(15.1939)	230.85	(3,508)	53,294	0.000018
-15.1	1	0.00000	(15.0939)	227.83	(3,439)	51,905	0.000018
-15.0	2	0.00000	(14.9939)	224.82	(3,371)	50,543	0.000019
-14.9	3	0.00000	(14.8939)	221.83	(3,304)	49,208	0.000020
-14.8	1	0.00000	(14.7939)	218.86	(3,238)	47,899	0.000021
-14.7	2	0.00000	(14.6939)	215.91	(3,173)	46,617	0.000021
-14.6	1	0.00000	(14.5939)	212.98	(3,108)	45,361	0.000022
-14.5	4	0.00000	(14.4939)	210.07	(3,045)	44,131	0.000024
-14.4	4	0.00000	(14.3939)	207.18	(2,982)	42,925	0.000025
-14.3	3	0.00000	(14.2939)	204.32	(2,920)	41,745	0.000026
-14.2	2	0.00000	(14.1939)	201.47	(2,860)	40,589	0.000027
-14.1	8	0.00000	(14.0939)	198.64	(2,800)	39,457	0.000031

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-14.0	13	0.000006	(13.9995)	195.99	(2,744)	38,411	0.000037
-13.9	12	0.000005	(13.8995)	193.20	(2,685)	37,325	0.000042
-13.8	9	0.000004	(13.7995)	190.43	(2,628)	36,262	0.000046
-13.7	11	0.000005	(13.6995)	187.68	(2,571)	35,222	0.000051
-13.6	11	0.000005	(13.5995)	184.95	(2,515)	34,205	0.000056
-13.5	19	0.000008	(13.4995)	182.24	(2,460)	33,210	0.000064
-13.4	22	0.000009	(13.3995)	179.55	(2,406)	32,237	0.000073
-13.3	17	0.000007	(13.2995)	176.88	(2,352)	31,285	0.000080
-13.2	15	0.000006	(13.1995)	174.23	(2,300)	30,355	0.000087
-13.1	16	0.000007	(13.0995)	171.60	(2,248)	29,446	0.000094
-13.0	30	0.000013	(12.9995)	168.99	(2,197)	28,557	0.000106
-12.9	24	0.000010	(12.8995)	166.40	(2,146)	27,688	0.000117
-12.8	17	0.000007	(12.7995)	163.83	(2,097)	26,839	0.000124
-12.7	24	0.000010	(12.6995)	161.28	(2,048)	26,010	0.000134
-12.6	27	0.000012	(12.5995)	158.75	(2,000)	25,201	0.000146
-12.5	36	0.000015	(12.4995)	156.24	(1,953)	24,410	0.000161
-12.4	25	0.000011	(12.3995)	153.75	(1,906)	23,638	0.000172
-12.3	31	0.000013	(12.2995)	151.28	(1,861)	22,885	0.000185
-12.2	25	0.000011	(12.1995)	148.83	(1,816)	22,150	0.000196
-12.1	43	0.000018	(12.0995)	146.40	(1,771)	21,432	0.000214
-12.0	51	0.000022	(11.9995)	143.99	(1,728)	20,733	0.000236
-11.9	33	0.000014	(11.8995)	141.60	(1,685)	20,050	0.000250
-11.8	52	0.000022	(11.7995)	139.23	(1,643)	19,385	0.000272
-11.7	70	0.000030	(11.6995)	136.88	(1,601)	18,736	0.000302
-11.6	49	0.000021	(11.5995)	134.55	(1,561)	18,103	0.000323
-11.5	61	0.000026	(11.4995)	132.24	(1,521)	17,487	0.000349
-11.4	43	0.000018	(11.3995)	129.95	(1,481)	16,887	0.000368
-11.3	125	0.000053	(11.2995)	127.68	(1,443)	16,302	0.000421
-11.2	49	0.000021	(11.1995)	125.43	(1,405)	15,732	0.000442
-11.1	64	0.000027	(11.0995)	123.20	(1,367)	15,178	0.000469
-11.0	107	0.000046	(10.9995)	120.99	(1,331)	14,638	0.000515
-10.9	84	0.000036	(10.8995)	118.80	(1,295)	14,113	0.000551
-10.8	73	0.000031	(10.7995)	116.63	(1,260)	13,602	0.000582
-10.7	135	0.000058	(10.6995)	114.48	(1,225)	13,106	0.000640
-10.6	112	0.000048	(10.5995)	112.35	(1,191)	12,622	0.000688

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-14.0	7	0.00000	(13.9939)	195.83	(2,740)	38,349	0.000034
-13.9	2	0.00000	(13.8939)	193.04	(2,682)	37,265	0.000035
-13.8	14	0.00001	(13.7939)	190.27	(2,625)	36,203	0.000041
-13.7	11	0.00000	(13.6939)	187.52	(2,568)	35,165	0.000045
-13.6	4	0.00000	(13.5939)	184.79	(2,512)	34,149	0.000047
-13.5	10	0.00000	(13.4939)	182.09	(2,457)	33,155	0.000051
-13.4	5	0.00000	(13.3939)	179.40	(2,403)	32,183	0.000053
-13.3	21	0.00001	(13.2939)	176.73	(2,349)	31,233	0.000062
-13.2	12	0.00001	(13.1939)	174.08	(2,297)	30,304	0.000068
-13.1	7	0.00000	(13.0939)	171.45	(2,245)	29,395	0.000071
-13.0	19	0.00001	(12.9939)	168.84	(2,194)	28,507	0.000079
-12.9	6	0.00000	(12.8939)	166.25	(2,144)	27,640	0.000081
-12.8	14	0.00001	(12.7939)	163.68	(2,094)	26,792	0.000087
-12.7	26	0.00001	(12.6939)	161.14	(2,045)	25,965	0.000098
-12.6	13	0.00001	(12.5939)	158.61	(1,997)	25,156	0.000104
-12.5	19	0.00001	(12.4939)	156.10	(1,950)	24,366	0.000112
-12.4	22	0.00001	(12.3939)	153.61	(1,904)	23,596	0.000121
-12.3	6	0.00000	(12.2939)	151.14	(1,858)	22,843	0.000124
-12.2	16	0.00001	(12.1939)	148.69	(1,813)	22,109	0.000131
-12.1	24	0.00001	(12.0939)	146.26	(1,769)	21,393	0.000141
-12.0	37	0.00002	(11.9939)	143.85	(1,725)	20,694	0.000157
-11.9	21	0.00001	(11.8939)	141.46	(1,683)	20,012	0.000166
-11.8	35	0.00001	(11.7939)	139.10	(1,640)	19,348	0.000181
-11.7	31	0.00001	(11.6939)	136.75	(1,599)	18,700	0.000194
-11.6	55	0.00002	(11.5939)	134.42	(1,558)	18,068	0.000218
-11.5	14	0.00001	(11.4939)	132.11	(1,518)	17,453	0.000224
-11.4	53	0.00002	(11.3939)	129.82	(1,479)	16,853	0.000246
-11.3	63	0.00003	(11.2939)	127.55	(1,441)	16,270	0.000273
-11.2	57	0.00002	(11.1939)	125.30	(1,403)	15,701	0.000297
-11.1	83	0.00004	(11.0939)	123.07	(1,365)	15,147	0.000333
-11.0	47	0.00002	(10.9939)	120.87	(1,329)	14,609	0.000353
-10.9	73	0.00003	(10.8939)	118.68	(1,293)	14,084	0.000384
-10.8	65	0.00003	(10.7939)	116.51	(1,258)	13,574	0.000412
-10.7	106	0.00005	(10.6939)	114.36	(1,223)	13,078	0.000457
-10.6	61	0.00003	(10.5939)	112.23	(1,189)	12,596	0.000483

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-10.5	128	0.000055	(10.4995)	110.24	(1,157)	12,153	0.000742
-10.4	164	0.000070	(10.3995)	108.15	(1,125)	11,696	0.000812
-10.3	110	0.000047	(10.2995)	106.08	(1,093)	11,253	0.000859
-10.2	137	0.000059	(10.1995)	104.03	(1,061)	10,822	0.000918
-10.1	149	0.000064	(10.0995)	102.00	(1,030)	10,404	0.000982
-10.0	262	0.000112	(9.9995)	99.99	(1,000)	9,998	0.001094
-9.9	157	0.000067	(9.8995)	98.00	(970)	9,604	0.001161
-9.8	272	0.000116	(9.7995)	96.03	(941)	9,222	0.001277
-9.7	235	0.000100	(9.6995)	94.08	(913)	8,851	0.001377
-9.6	314	0.000134	(9.5995)	92.15	(885)	8,492	0.001512
-9.5	155	0.000066	(9.4995)	90.24	(857)	8,143	0.001578
-9.4	338	0.000144	(9.3995)	88.35	(830)	7,806	0.001722
-9.3	344	0.000147	(9.2995)	86.48	(804)	7,479	0.001869
-9.2	292	0.000125	(9.1995)	84.63	(779)	7,162	0.001994
-9.1	436	0.000186	(9.0995)	82.80	(753)	6,856	0.002180
-9.0	293	0.000125	(8.9995)	80.99	(729)	6,560	0.002306
-8.9	461	0.000197	(8.8995)	79.20	(705)	6,273	0.002503
-8.8	417	0.000178	(8.7995)	77.43	(681)	5,996	0.002681
-8.7	539	0.000230	(8.6995)	75.68	(658)	5,728	0.002911
-8.6	443	0.000189	(8.5995)	73.95	(636)	5,469	0.003100
-8.5	623	0.000266	(8.4995)	72.24	(614)	5,219	0.003367
-8.4	600	0.000256	(8.3995)	70.55	(593)	4,978	0.003623
-8.3	576	0.000246	(8.2995)	68.88	(572)	4,745	0.003869
-8.2	563	0.000241	(8.1995)	67.23	(551)	4,520	0.004110
-8.1	593	0.000253	(8.0995)	65.60	(531)	4,304	0.004363
-8.0	849	0.000363	(7.9995)	63.99	(512)	4,095	0.004726
-7.9	873	0.000373	(7.8995)	62.40	(493)	3,894	0.005099
-7.8	964	0.000412	(7.7995)	60.83	(474)	3,701	0.005511
-7.7	654	0.000279	(7.6995)	59.28	(456)	3,514	0.005791
-7.6	1,030	0.000440	(7.5995)	57.75	(439)	3,335	0.006231
-7.5	1,034	0.000442	(7.4995)	56.24	(422)	3,163	0.006673
-7.4	768	0.000328	(7.3995)	54.75	(405)	2,998	0.007001
-7.3	1,164	0.000497	(7.2995)	53.28	(389)	2,839	0.007498
-7.2	1,203	0.000514	(7.1995)	51.83	(373)	2,687	0.008012
-7.1	1,263	0.000540	(7.0995)	50.40	(358)	2,540	0.008552

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-10.5	152	0.00006	(10.4939)	110.12	(1,156)	12,127	0.000548
-10.4	142	0.00006	(10.3939)	108.03	(1,123)	11,671	0.000609
-10.3	153	0.00007	(10.2939)	105.96	(1,091)	11,228	0.000674
-10.2	103	0.00004	(10.1939)	103.92	(1,059)	10,798	0.000718
-10.1	134	0.00006	(10.0939)	101.89	(1,028)	10,381	0.000776
-10.0	184	0.00008	(9.9939)	99.88	(998)	9,976	0.000854
-9.9	207	0.00009	(9.8939)	97.89	(969)	9,582	0.000943
-9.8	245	0.00010	(9.7939)	95.92	(939)	9,201	0.001047
-9.7	116	0.00005	(9.6939)	93.97	(911)	8,831	0.001097
-9.6	218	0.00009	(9.5939)	92.04	(883)	8,472	0.001190
-9.5	219	0.00009	(9.4939)	90.13	(856)	8,124	0.001284
-9.4	190	0.00008	(9.3939)	88.25	(829)	7,787	0.001365
-9.3	293	0.00013	(9.2939)	86.38	(803)	7,461	0.001490
-9.2	265	0.00011	(9.1939)	84.53	(777)	7,145	0.001603
-9.1	311	0.00013	(9.0939)	82.70	(752)	6,839	0.001736
-9.0	341	0.00015	(8.9939)	80.89	(728)	6,543	0.001882
-8.9	363	0.00016	(8.8939)	79.10	(704)	6,257	0.002037
-8.8	360	0.00015	(8.7939)	77.33	(680)	5,980	0.002191
-8.7	538	0.00023	(8.6939)	75.58	(657)	5,713	0.002421
-8.6	403	0.00017	(8.5939)	73.86	(635)	5,455	0.002593
-8.5	502	0.00021	(8.4939)	72.15	(613)	5,205	0.002808
-8.4	412	0.00018	(8.3939)	70.46	(591)	4,964	0.002984
-8.3	485	0.00021	(8.2939)	68.79	(571)	4,732	0.003191
-8.2	499	0.00021	(8.1939)	67.14	(550)	4,508	0.003404
-8.1	568	0.00024	(8.0939)	65.51	(530)	4,292	0.003647
-8.0	771	0.00033	(7.9939)	63.90	(511)	4,084	0.003977
-7.9	637	0.00027	(7.8939)	62.31	(492)	3,883	0.004249
-7.8	730	0.00031	(7.7939)	60.74	(473)	3,690	0.004561
-7.7	746	0.00032	(7.6939)	59.20	(455)	3,504	0.004879
-7.6	751	0.00032	(7.5939)	57.67	(438)	3,326	0.005200
-7.5	610	0.00026	(7.4939)	56.16	(421)	3,154	0.005461
-7.4	922	0.00039	(7.3939)	54.67	(404)	2,989	0.005855
-7.3	1,060	0.00045	(7.2939)	53.20	(388)	2,830	0.006308
-7.2	1,192	0.00051	(7.1939)	51.75	(372)	2,678	0.006818
-7.1	1,064	0.00045	(7.0939)	50.32	(357)	2,532	0.007272

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-7.0	1,250	0.000534	(6.9995)	48.99	(343)	2,400	0.009086
-6.9	1,347	0.000576	(6.8995)	47.60	(328)	2,266	0.009662
-6.8	1,297	0.000554	(6.7995)	46.23	(314)	2,138	0.010216
-6.7	1,839	0.000786	(6.6995)	44.88	(301)	2,015	0.011002
-6.6	1,406	0.000601	(6.5995)	43.55	(287)	1,897	0.011603
-6.5	1,699	0.000726	(6.4995)	42.24	(275)	1,785	0.012329
-6.4	1,499	0.000641	(6.3995)	40.95	(262)	1,677	0.012970
-6.3	1,745	0.000746	(6.2995)	39.68	(250)	1,575	0.013715
-6.2	1,873	0.000800	(6.1995)	38.43	(238)	1,477	0.014516
-6.1	1,883	0.000805	(6.0995)	37.20	(227)	1,384	0.015321
-6.0	2,520	0.001077	(5.9995)	35.99	(216)	1,296	0.016398
-5.9	2,196	0.000938	(5.8995)	34.80	(205)	1,211	0.017336
-5.8	2,530	0.001081	(5.7995)	33.63	(195)	1,131	0.018417
-5.7	2,602	0.001112	(5.6995)	32.48	(185)	1,055	0.019529
-5.6	2,714	0.001160	(5.5995)	31.35	(176)	983	0.020689
-5.5	2,549	0.001089	(5.4995)	30.24	(166)	915	0.021778
-5.4	3,225	0.001378	(5.3995)	29.15	(157)	850	0.023157
-5.3	3,506	0.001498	(5.2995)	28.08	(149)	789	0.024655
-5.2	3,742	0.001599	(5.1995)	27.03	(141)	731	0.026254
-5.1	3,635	0.001553	(5.0995)	26.00	(133)	676	0.027807
-5.0	3,985	0.001703	(4.9995)	25.00	(125)	625	0.029510
-4.9	4,097	0.001751	(4.8995)	24.01	(118)	576	0.031261
-4.8	4,093	0.001749	(4.7995)	23.04	(111)	531	0.033010
-4.7	4,971	0.002124	(4.6995)	22.09	(104)	488	0.035135
-4.6	5,102	0.002180	(4.5995)	21.16	(97)	448	0.037315
-4.5	4,618	0.001974	(4.4995)	20.25	(91)	410	0.039289
-4.4	5,833	0.002493	(4.3995)	19.36	(85)	375	0.041781
-4.3	5,827	0.002490	(4.2995)	18.49	(79)	342	0.044272
-4.2	5,790	0.002474	(4.1995)	17.64	(74)	311	0.046746
-4.1	5,943	0.002540	(4.0995)	16.81	(69)	282	0.049286
-4.0	7,143	0.003053	(3.9995)	16.00	(64)	256	0.052338
-3.9	7,280	0.003111	(3.8995)	15.21	(59)	231	0.055449
-3.8	7,310	0.003124	(3.7995)	14.44	(55)	208	0.058573
-3.7	8,465	0.003618	(3.6995)	13.69	(51)	187	0.062191
-3.6	8,530	0.003645	(3.5995)	12.96	(47)	168	0.065836

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-7.0	1,089	0.00047	(6.9939)	48.91	(342)	2,393	0.007738
-6.9	1,147	0.00049	(6.8939)	47.53	(328)	2,259	0.008228
-6.8	1,139	0.00049	(6.7939)	46.16	(314)	2,130	0.008715
-6.7	1,586	0.00068	(6.6939)	44.81	(300)	2,008	0.009392
-6.6	1,649	0.00070	(6.5939)	43.48	(287)	1,890	0.010097
-6.5	1,339	0.00057	(6.4939)	42.17	(274)	1,778	0.010669
-6.4	1,891	0.00081	(6.3939)	40.88	(261)	1,671	0.011477
-6.3	1,799	0.00077	(6.2939)	39.61	(249)	1,569	0.012246
-6.2	1,753	0.00075	(6.1939)	38.36	(238)	1,472	0.012995
-6.1	1,745	0.00075	(6.0939)	37.14	(226)	1,379	0.013741
-6.0	2,248	0.00096	(5.9939)	35.93	(215)	1,291	0.014702
-5.9	2,401	0.00103	(5.8939)	34.74	(205)	1,207	0.015728
-5.8	2,293	0.00098	(5.7939)	33.57	(194)	1,127	0.016708
-5.7	2,676	0.00114	(5.6939)	32.42	(185)	1,051	0.017851
-5.6	2,673	0.00114	(5.5939)	31.29	(175)	979	0.018994
-5.5	2,483	0.00106	(5.4939)	30.18	(166)	911	0.020055
-5.4	2,814	0.00120	(5.3939)	29.09	(157)	846	0.021257
-5.3	3,543	0.00151	(5.2939)	28.03	(148)	785	0.022771
-5.2	3,216	0.00137	(5.1939)	26.98	(140)	728	0.024146
-5.1	3,726	0.00159	(5.0939)	25.95	(132)	673	0.025738
-5.0	4,247	0.00181	(4.9939)	24.94	(125)	622	0.027553
-4.9	3,569	0.00153	(4.8939)	23.95	(117)	574	0.029078
-4.8	4,440	0.00190	(4.7939)	22.98	(110)	528	0.030976
-4.7	4,628	0.00198	(4.6939)	22.03	(103)	485	0.032953
-4.6	5,208	0.00223	(4.5939)	21.10	(97)	445	0.035179
-4.5	4,958	0.00212	(4.4939)	20.20	(91)	408	0.037298
-4.4	5,505	0.00235	(4.3939)	19.31	(85)	373	0.039651
-4.3	5,657	0.00242	(4.2939)	18.44	(79)	340	0.042068
-4.2	5,889	0.00252	(4.1939)	17.59	(74)	309	0.044585
-4.1	6,149	0.00263	(4.0939)	16.76	(69)	281	0.047212
-4.0	6,962	0.00298	(3.9939)	15.95	(64)	254	0.050188
-3.9	8,058	0.00344	(3.8939)	15.16	(59)	230	0.053631
-3.8	7,176	0.00307	(3.7939)	14.39	(55)	207	0.056698
-3.7	7,614	0.00325	(3.6939)	13.64	(50)	186	0.059952
-3.6	8,361	0.00357	(3.5939)	12.92	(46)	167	0.063525

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-3.5	8,459	0.003615	(3.4995)	12.25	(43)	150	0.069451
-3.4	9,304	0.003976	(3.3995)	11.56	(39)	134	0.073427
-3.3	10,733	0.004587	(3.2995)	10.89	(36)	119	0.078014
-3.2	10,444	0.004463	(3.1995)	10.24	(33)	105	0.082477
-3.1	11,434	0.004886	(3.0995)	9.61	(30)	92	0.087364
-3.0	12,872	0.005501	(2.9995)	9.00	(27)	81	0.092865
-2.9	11,414	0.004878	(2.8995)	8.41	(24)	71	0.097742
-2.8	13,749	0.005876	(2.7995)	7.84	(22)	61	0.103618
-2.7	13,793	0.005894	(2.6995)	7.29	(20)	53	0.109513
-2.6	15,475	0.006613	(2.5995)	6.76	(18)	46	0.116126
-2.5	15,445	0.006600	(2.4995)	6.25	(16)	39	0.122726
-2.4	17,266	0.007379	(2.3995)	5.76	(14)	33	0.130105
-2.3	17,414	0.007442	(2.2995)	5.29	(12)	28	0.137547
-2.2	18,205	0.007780	(2.1995)	4.84	(11)	23	0.145327
-2.1	19,266	0.008233	(2.0995)	4.41	(9)	19	0.153560
-2.0	21,030	0.008987	(1.9995)	4.00	(8)	16	0.162547
-1.9	23,833	0.010185	(1.8995)	3.61	(7)	13	0.172733
-1.8	22,613	0.009664	(1.7995)	3.24	(6)	10	0.182396
-1.7	24,144	0.010318	(1.6995)	2.89	(5)	8	0.192714
-1.6	26,913	0.011501	(1.5995)	2.56	(4)	7	0.204216
-1.5	27,424	0.011720	(1.4995)	2.25	(3)	5	0.215935
-1.4	28,936	0.012366	(1.3995)	1.96	(3)	4	0.228301
-1.3	35,052	0.014980	(1.2995)	1.69	(2)	3	0.243281
-1.2	31,928	0.013645	(1.1995)	1.44	(2)	2	0.256925
-1.1	34,599	0.014786	(1.0995)	1.21	(1)	1	0.271711
-1.0	38,299	0.016367	(0.9995)	1.00	(1)	1	0.288078
-0.9	38,952	0.016646	(0.8995)	0.81	(1)	1	0.304725
-0.8	42,808	0.018294	(0.7995)	0.64	(1)	0	0.323019
-0.7	44,620	0.019068	(0.6995)	0.49	(0)	0	0.342087
-0.6	49,026	0.020951	(0.5995)	0.36	(0)	0	0.363039
-0.5	50,622	0.021633	(0.4995)	0.25	(0)	0	0.384672
-0.4	57,134	0.024416	(0.3995)	0.16	(0)	0	0.409088
-0.3	55,103	0.023548	(0.2995)	0.09	(0)	0	0.432637
-0.2	65,816	0.028127	(0.1995)	0.04	(0)	0	0.460763
-0.1	58,290	0.024910	(0.0995)	0.01	(0)	0	0.485674

Hi-Low True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-3.5	8,459	0.00361	(3.4939)	12.21	(43)	149	0.067140
-3.4	9,301	0.00397	(3.3939)	11.52	(39)	133	0.071115
-3.3	11,461	0.00490	(3.2939)	10.85	(36)	118	0.076013
-3.2	9,943	0.00425	(3.1939)	10.20	(33)	104	0.080262
-3.1	11,213	0.00479	(3.0939)	9.57	(30)	92	0.085054
-3.0	11,600	0.00496	(2.9939)	8.96	(27)	80	0.090011
-2.9	11,858	0.00507	(2.8939)	8.37	(24)	70	0.095078
-2.8	13,392	0.00572	(2.7939)	7.81	(22)	61	0.100801
-2.7	13,558	0.00579	(2.6939)	7.26	(20)	53	0.106596
-2.6	15,168	0.00648	(2.5939)	6.73	(17)	45	0.113078
-2.5	16,201	0.00692	(2.4939)	6.22	(16)	39	0.120001
-2.4	16,742	0.00715	(2.3939)	5.73	(14)	33	0.127156
-2.3	17,497	0.00748	(2.2939)	5.26	(12)	28	0.134633
-2.2	17,904	0.00765	(2.1939)	4.81	(11)	23	0.142284
-2.1	19,157	0.00819	(2.0939)	4.38	(9)	19	0.150471
-2.0	21,955	0.00938	(1.9939)	3.98	(8)	16	0.159854
-1.9	21,783	0.00931	(1.8939)	3.59	(7)	13	0.169163
-1.8	24,445	0.01045	(1.7939)	3.22	(6)	10	0.179609
-1.7	25,120	0.01074	(1.6939)	2.87	(5)	8	0.190344
-1.6	25,577	0.01093	(1.5939)	2.54	(4)	6	0.201275
-1.5	27,680	0.01183	(1.4939)	2.23	(3)	5	0.213104
-1.4	28,215	0.01206	(1.3939)	1.94	(3)	4	0.225162
-1.3	33,538	0.01433	(1.2939)	1.67	(2)	3	0.239494
-1.2	33,802	0.01445	(1.1939)	1.43	(2)	2	0.253939
-1.1	37,759	0.01614	(1.0939)	1.20	(1)	1	0.270076
-1.0	36,028	0.01540	(0.9939)	0.99	(1)	1	0.285472
-0.9	42,184	0.01803	(0.8939)	0.80	(1)	1	0.303500
-0.8	38,407	0.01641	(0.7939)	0.63	(1)	0	0.319913
-0.7	46,363	0.01981	(0.6939)	0.48	(0)	0	0.339726
-0.6	49,028	0.02095	(0.5939)	0.35	(0)	0	0.360679
-0.5	53,447	0.02284	(0.4939)	0.24	(0)	0	0.383519
-0.4	63,812	0.02727	(0.3939)	0.16	(0)	0	0.410789
-0.3	46,001	0.01966	(0.2939)	0.09	(0)	0	0.430448
-0.2	86,572	0.03700	(0.1939)	0.04	(0)	0	0.467445
-0.1	-	-	(0.0939)	0.01	(0)	0	0.467445

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - µ)	(X - µ)^2	(X - µ)^3	(X - µ)^4	F(x)
0.0	65,415	0.027955	0.0005	0.00	0	0	0.513629
0.1	66,836	0.028563	0.1005	0.01	0	0	0.542192
0.2	59,061	0.025240	0.2005	0.04	0	0	0.567432
0.3	61,339	0.026213	0.3005	0.09	0	0	0.593645
0.4	52,277	0.022341	0.4005	0.16	0	0	0.615986
0.5	50,319	0.021504	0.5005	0.25	0	0	0.637490
0.6	48,673	0.020801	0.6005	0.36	0	0	0.658290
0.7	44,227	0.018901	0.7005	0.49	0	0	0.677191
0.8	43,177	0.018452	0.8005	0.64	1	0	0.695642
0.9	42,045	0.017968	0.9005	0.81	1	1	0.713610
1.0	35,747	0.015277	1.0005	1.00	1	1	0.728887
1.1	35,792	0.015296	1.1005	1.21	1	1	0.744183
1.2	30,912	0.013210	1.2005	1.44	2	2	0.757393
1.3	28,493	0.012177	1.3005	1.69	2	3	0.769570
1.4	34,594	0.014784	1.4005	1.96	3	4	0.784354
1.5	28,148	0.012029	1.5005	2.25	3	5	0.796383
1.6	29,610	0.012654	1.6005	2.56	4	7	0.809037
1.7	22,520	0.009624	1.7005	2.89	5	8	0.818661
1.8	19,408	0.008294	1.8005	3.24	6	11	0.826955
1.9	-	-	1.9005	3.61	7	13	0.826955
2.0	67,913	0.029023	2.0005	4.00	8	16	0.855977
2.1	-	-	2.1005	4.41	9	19	0.855977
2.2	12,056	0.005152	2.2005	4.84	11	23	0.861130
2.3	18,426	0.007874	2.3005	5.29	12	28	0.869004
2.4	17,297	0.007392	2.4005	5.76	14	33	0.876396
2.5	17,768	0.007593	2.5005	6.25	16	39	0.883989
2.6	17,074	0.007297	2.6005	6.76	18	46	0.891286
2.7	12,932	0.005527	2.7005	7.29	20	53	0.896812
2.8	11,716	0.005007	2.8005	7.84	22	62	0.901819
2.9	12,092	0.005168	2.9005	8.41	24	71	0.906987
3.0	11,579	0.004948	3.0005	9.00	27	81	0.911935
3.1	12,048	0.005149	3.1005	9.61	30	92	0.917084
3.2	11,132	0.004757	3.2005	10.24	33	105	0.921841
3.3	11,177	0.004777	3.3005	10.89	36	119	0.926618
3.4	8,717	0.003725	3.4005	11.56	39	134	0.930343

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - µ)	(X - µ)^2	(X - µ)^3	(X - µ)^4	F(x)
0.0	159,471	0.06815	0.0061	0.00	0	0	0.535595
0.1	-	-	0.1061	0.01	0	0	0.535595
0.2	86,507	0.03697	0.2061	0.04	0	0	0.572564
0.3	45,687	0.01952	0.3061	0.09	0	0	0.592088
0.4	63,640	0.02720	0.4061	0.16	0	0	0.619285
0.5	53,152	0.02271	0.5061	0.26	0	0	0.641999
0.6	48,947	0.02092	0.6061	0.37	0	0	0.662917
0.7	45,982	0.01965	0.7061	0.50	0	0	0.682567
0.8	38,844	0.01660	0.8061	0.65	1	0	0.699167
0.9	42,004	0.01795	0.9061	0.82	1	1	0.717118
1.0	35,753	0.01528	1.0061	1.01	1	1	0.732397
1.1	38,066	0.01627	1.1061	1.22	1	1	0.748664
1.2	33,383	0.01427	1.2061	1.45	2	2	0.762931
1.3	33,185	0.01418	1.3061	1.71	2	3	0.777112
1.4	27,585	0.01179	1.4061	1.98	3	4	0.788901
1.5	27,392	0.01171	1.5061	2.27	3	5	0.800607
1.6	25,688	0.01098	1.6061	2.58	4	7	0.811585
1.7	24,718	0.01056	1.7061	2.91	5	8	0.822148
1.8	24,403	0.01043	1.8061	3.26	6	11	0.832577
1.9	21,898	0.00936	1.9061	3.63	7	13	0.841935
2.0	21,607	0.00923	2.0061	4.02	8	16	0.851168
2.1	18,892	0.00807	2.1061	4.44	9	20	0.859242
2.2	17,673	0.00755	2.2061	4.87	11	24	0.866795
2.3	17,022	0.00727	2.3061	5.32	12	28	0.874069
2.4	16,324	0.00698	2.4061	5.79	14	34	0.881045
2.5	16,114	0.00689	2.5061	6.28	16	39	0.887931
2.6	14,907	0.00637	2.6061	6.79	18	46	0.894302
2.7	13,165	0.00563	2.7061	7.32	20	54	0.899928
2.8	12,902	0.00551	2.8061	7.87	22	62	0.905442
2.9	11,784	0.00504	2.9061	8.45	25	71	0.910478
3.0	11,683	0.00499	3.0061	9.04	27	82	0.915470
3.1	10,863	0.00464	3.1061	9.65	30	93	0.920113
3.2	9,962	0.00426	3.2061	10.28	33	106	0.924370
3.3	11,525	0.00493	3.3061	10.93	36	119	0.929295
3.4	9,087	0.00388	3.4061	11.60	40	135	0.933178

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
3.5	8,312	0.003552	3.5005	12.25	43	150	0.933895
3.6	8,219	0.003512	3.6005	12.96	47	168	0.937407
3.7	8,335	0.003562	3.7005	13.69	51	188	0.940969
3.8	7,989	0.003414	3.8005	14.44	55	209	0.944383
3.9	7,515	0.003212	3.9005	15.21	59	231	0.947595
4.0	7,343	0.003138	4.0005	16.00	64	256	0.950733
4.1	6,049	0.002585	4.1005	16.81	69	283	0.953318
4.2	5,943	0.002540	4.2005	17.64	74	311	0.955858
4.3	5,719	0.002444	4.3005	18.49	80	342	0.958302
4.4	5,423	0.002318	4.4005	19.36	85	375	0.960619
4.5	5,513	0.002356	4.5005	20.25	91	410	0.962975
4.6	5,114	0.002185	4.6005	21.16	97	448	0.965161
4.7	4,343	0.001856	4.7005	22.09	104	488	0.967017
4.8	4,097	0.001751	4.8005	23.04	111	531	0.968768
4.9	3,852	0.001646	4.9005	24.01	118	577	0.970414
5.0	3,823	0.001634	5.0005	25.00	125	625	0.972048
5.1	3,733	0.001595	5.1005	26.02	133	677	0.973643
5.2	3,204	0.001369	5.2005	27.05	141	731	0.975012
5.3	3,984	0.001703	5.3005	28.10	149	789	0.976715
5.4	2,909	0.001243	5.4005	29.17	158	851	0.977958
5.5	2,829	0.001209	5.5005	30.26	166	915	0.979167
5.6	2,806	0.001199	5.6005	31.37	176	984	0.980366
5.7	2,444	0.001044	5.7005	32.50	185	1,056	0.981411
5.8	2,344	0.001002	5.8005	33.65	195	1,132	0.982412
5.9	2,779	0.001188	5.9005	34.82	205	1,212	0.983600
6.0	2,392	0.001022	6.0005	36.01	216	1,296	0.984622
6.1	1,948	0.000832	6.1005	37.22	227	1,385	0.985455
6.2	1,971	0.000842	6.2005	38.45	238	1,478	0.986297
6.3	1,921	0.000821	6.3005	39.70	250	1,576	0.987118
6.4	1,737	0.000742	6.4005	40.97	262	1,678	0.987860
6.5	1,614	0.000690	6.5005	42.26	275	1,786	0.988550
6.6	1,829	0.000782	6.6005	43.57	288	1,898	0.989332
6.7	1,481	0.000633	6.7005	44.90	301	2,016	0.989964
6.8	1,388	0.000593	6.8005	46.25	315	2,139	0.990558
6.9	1,100	0.000470	6.9005	47.62	329	2,267	0.991028

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
3.5	8,505	0.00363	3.5061	12.29	43	151	0.936813
3.6	8,501	0.00363	3.6061	13.00	47	169	0.940446
3.7	7,544	0.00322	3.7061	13.74	51	189	0.943670
3.8	7,327	0.00313	3.8061	14.49	55	210	0.946801
3.9	7,925	0.00339	3.9061	15.26	60	233	0.950188
4.0	6,930	0.00296	4.0061	16.05	64	258	0.953149
4.1	5,996	0.00256	4.1061	16.86	69	284	0.955712
4.2	5,761	0.00246	4.2061	17.69	74	313	0.958174
4.3	5,519	0.00236	4.3061	18.54	80	344	0.960532
4.4	5,478	0.00234	4.4061	19.41	86	377	0.962873
4.5	4,925	0.00210	4.5061	20.30	91	412	0.964978
4.6	4,984	0.00213	4.6061	21.22	98	450	0.967108
4.7	4,304	0.00184	4.7061	22.15	104	491	0.968947
4.8	4,313	0.00184	4.8061	23.10	111	534	0.970791
4.9	3,485	0.00149	4.9061	24.07	118	579	0.972280
5.0	4,189	0.00179	5.0061	25.06	125	628	0.974070
5.1	3,691	0.00158	5.1061	26.07	133	680	0.975647
5.2	3,317	0.00142	5.2061	27.10	141	735	0.977065
5.3	3,564	0.00152	5.3061	28.15	149	793	0.978588
5.4	2,958	0.00126	5.4061	29.23	158	854	0.979852
5.5	2,571	0.00110	5.5061	30.32	167	919	0.980951
5.6	2,744	0.00117	5.6061	31.43	176	988	0.982123
5.7	2,665	0.00114	5.7061	32.56	186	1,060	0.983262
5.8	2,355	0.00101	5.8061	33.71	196	1,136	0.984269
5.9	2,354	0.00101	5.9061	34.88	206	1,217	0.985275
6.0	2,394	0.00102	6.0061	36.07	217	1,301	0.986298
6.1	1,828	0.00078	6.1061	37.28	228	1,390	0.987079
6.2	1,838	0.00079	6.2061	38.52	239	1,483	0.987865
6.3	1,770	0.00076	6.3061	39.77	251	1,581	0.988621
6.4	1,895	0.00081	6.4061	41.04	263	1,684	0.989431
6.5	1,342	0.00057	6.5061	42.33	275	1,792	0.990004
6.6	1,601	0.00068	6.6061	43.64	288	1,904	0.990688
6.7	1,545	0.00066	6.7061	44.97	302	2,022	0.991349
6.8	1,109	0.00047	6.8061	46.32	315	2,146	0.991823
6.9	1,178	0.00050	6.9061	47.69	329	2,275	0.992326

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
7.0	1,404	0.000600	7.0005	49.01	343	2,402	0.991628
7.1	1,267	0.000541	7.1005	50.42	358	2,542	0.992169
7.2	1,058	0.000452	7.2005	51.85	373	2,688	0.992621
7.3	1,262	0.000539	7.3005	53.30	389	2,841	0.993161
7.4	916	0.000391	7.4005	54.77	405	2,999	0.993552
7.5	780	0.000333	7.5005	56.26	422	3,165	0.993885
7.6	863	0.000369	7.6005	57.77	439	3,337	0.994254
7.7	832	0.000356	7.7005	59.30	457	3,516	0.994610
7.8	776	0.000332	7.8005	60.85	475	3,702	0.994941
7.9	770	0.000329	7.9005	62.42	493	3,896	0.995270
8.0	790	0.000338	8.0005	64.01	512	4,097	0.995608
8.1	517	0.000221	8.1005	65.62	532	4,306	0.995829
8.2	546	0.000233	8.2005	67.25	551	4,522	0.996062
8.3	621	0.000265	8.3005	68.90	572	4,747	0.996328
8.4	596	0.000255	8.4005	70.57	593	4,980	0.996582
8.5	376	0.000161	8.5005	72.26	614	5,221	0.996743
8.6	533	0.000228	8.6005	73.97	636	5,471	0.996971
8.7	550	0.000235	8.7005	75.70	659	5,730	0.997206
8.8	357	0.000153	8.8005	77.45	682	5,998	0.997359
8.9	392	0.000168	8.9005	79.22	705	6,276	0.997526
9.0	372	0.000159	9.0005	81.01	729	6,562	0.997685
9.1	349	0.000149	9.1005	82.82	754	6,859	0.997834
9.2	415	0.000177	9.2005	84.65	779	7,165	0.998012
9.3	390	0.000167	9.3005	86.50	804	7,482	0.998178
9.4	300	0.000128	9.4005	88.37	831	7,809	0.998306
9.5	206	0.000088	9.5005	90.26	858	8,147	0.998394
9.6	252	0.000108	9.6005	92.17	885	8,495	0.998502
9.7	240	0.000103	9.7005	94.10	913	8,855	0.998605
9.8	235	0.000100	9.8005	96.05	941	9,226	0.998705
9.9	216	0.000092	9.9005	98.02	970	9,608	0.998797
10.0	258	0.000110	10.0005	100.01	1,000	10,002	0.998908
10.1	159	0.000068	10.1005	102.02	1,030	10,408	0.998976
10.2	158	0.000068	10.2005	104.05	1,061	10,826	0.999043
10.3	170	0.000073	10.3005	106.10	1,093	11,257	0.999116
10.4	100	0.000043	10.4005	108.17	1,125	11,701	0.999159

Hi-Low True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
7.0	1,124	0.00048	7.0061	49.09	344	2,409	0.992806
7.1	1,038	0.00044	7.1061	50.50	359	2,550	0.993250
7.2	1,130	0.00048	7.2061	51.93	374	2,697	0.993733
7.3	1,042	0.00045	7.3061	53.38	390	2,849	0.994178
7.4	917	0.00039	7.4061	54.85	406	3,009	0.994570
7.5	686	0.00029	7.5061	56.34	423	3,174	0.994863
7.6	810	0.00035	7.6061	57.85	440	3,347	0.995209
7.7	729	0.00031	7.7061	59.38	458	3,526	0.995521
7.8	675	0.00029	7.8061	60.94	476	3,713	0.995809
7.9	627	0.00027	7.9061	62.51	494	3,907	0.996077
8.0	805	0.00034	8.0061	64.10	513	4,109	0.996421
8.1	505	0.00022	8.1061	65.71	533	4,318	0.996637
8.2	460	0.00020	8.2061	67.34	553	4,535	0.996834
8.3	495	0.00021	8.3061	68.99	573	4,760	0.997045
8.4	363	0.00016	8.4061	70.66	594	4,993	0.997200
8.5	439	0.00019	8.5061	72.35	615	5,235	0.997388
8.6	389	0.00017	8.6061	74.06	637	5,486	0.997554
8.7	495	0.00021	8.7061	75.80	660	5,745	0.997766
8.8	331	0.00014	8.8061	77.55	683	6,014	0.997907
8.9	353	0.00015	8.9061	79.32	706	6,291	0.998058
9.0	300	0.00013	9.0061	81.11	730	6,579	0.998186
9.1	318	0.00014	9.1061	82.92	755	6,876	0.998322
9.2	274	0.00012	9.2061	84.75	780	7,183	0.998439
9.3	315	0.00013	9.3061	86.60	806	7,500	0.998574
9.4	154	0.00007	9.4061	88.47	832	7,828	0.998640
9.5	214	0.00009	9.5061	90.37	859	8,166	0.998731
9.6	236	0.00010	9.6061	92.28	886	8,515	0.998832
9.7	122	0.00005	9.7061	94.21	914	8,875	0.998884
9.8	198	0.00008	9.8061	96.16	943	9,247	0.998969
9.9	194	0.00008	9.9061	98.13	972	9,630	0.999052
10.0	193	0.00008	10.0061	100.12	1,002	10,024	0.999134
10.1	110	0.00005	10.1061	102.13	1,032	10,431	0.999181
10.2	104	0.00004	10.2061	104.16	1,063	10,850	0.999226
10.3	149	0.00006	10.3061	106.22	1,095	11,282	0.999289
10.4	122	0.00005	10.4061	108.29	1,127	11,726	0.999341

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
10.5	147	0.000063	10.5005	110.26	1,158	12,157	0.999221
10.6	117	0.000050	10.6005	112.37	1,191	12,627	0.999271
10.7	160	0.000068	10.7005	114.50	1,225	13,110	0.999340
10.8	104	0.000044	10.8005	116.65	1,260	13,607	0.999384
10.9	107	0.000046	10.9005	118.82	1,295	14,118	0.999430
11.0	98	0.000042	11.0005	121.01	1,331	14,644	0.999472
11.1	98	0.000042	11.1005	123.22	1,368	15,183	0.999514
11.2	85	0.000036	11.2005	125.45	1,405	15,738	0.999550
11.3	83	0.000035	11.3005	127.70	1,443	16,308	0.999585
11.4	40	0.000017	11.4005	129.97	1,482	16,893	0.999603
11.5	59	0.000025	11.5005	132.26	1,521	17,493	0.999628
11.6	71	0.000030	11.6005	134.57	1,561	18,109	0.999658
11.7	35	0.000015	11.7005	136.90	1,602	18,742	0.999673
11.8	59	0.000025	11.8005	139.25	1,643	19,391	0.999698
11.9	57	0.000024	11.9005	141.62	1,685	20,057	0.999723
12.0	63	0.000027	12.0005	144.01	1,728	20,739	0.999750
12.1	37	0.000016	12.1005	146.42	1,772	21,439	0.999765
12.2	22	0.000009	12.2005	148.85	1,816	22,157	0.999775
12.3	36	0.000015	12.3005	151.30	1,861	22,892	0.999790
12.4	39	0.000017	12.4005	153.77	1,907	23,646	0.999807
12.5	44	0.000019	12.5005	156.26	1,953	24,418	0.999826
12.6	14	0.000006	12.6005	158.77	2,001	25,209	0.999832
12.7	34	0.000015	12.7005	161.30	2,049	26,018	0.999846
12.8	22	0.000009	12.8005	163.85	2,097	26,848	0.999856
12.9	24	0.000010	12.9005	166.42	2,147	27,697	0.999866
13.0	16	0.000007	13.0005	169.01	2,197	28,565	0.999873
13.1	17	0.000007	13.1005	171.62	2,248	29,454	0.999880
13.2	29	0.000012	13.2005	174.25	2,300	30,364	0.999892
13.3	21	0.000009	13.3005	176.90	2,353	31,295	0.999901
13.4	21	0.000009	13.4005	179.57	2,406	32,247	0.999910
13.5	11	0.000005	13.5005	182.26	2,461	33,220	0.999915
13.6	14	0.000006	13.6005	184.97	2,516	34,215	0.999921
13.7	16	0.000007	13.7005	187.70	2,572	35,233	0.999928
13.8	14	0.000006	13.8005	190.45	2,628	36,273	0.999934
13.9	11	0.000005	13.9005	193.22	2,686	37,335	0.999938

Hi-Low True Count Distribution

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
10.5	122	0.00005	10.5061	110.38	1,160	12,183	0.999394
10.6	67	0.00003	10.6061	112.49	1,193	12,654	0.999422
10.7	114	0.00005	10.7061	114.62	1,227	13,138	0.999471
10.8	81	0.00003	10.8061	116.77	1,262	13,636	0.999506
10.9	94	0.00004	10.9061	118.94	1,297	14,147	0.999546
11.0	50	0.00002	11.0061	121.13	1,333	14,673	0.999567
11.1	92	0.00004	11.1061	123.35	1,370	15,214	0.999606
11.2	59	0.00003	11.2061	125.58	1,407	15,769	0.999632
11.3	55	0.00002	11.3061	127.83	1,445	16,340	0.999655
11.4	53	0.00002	11.4061	130.10	1,484	16,926	0.999678
11.5	23	0.00001	11.5061	132.39	1,523	17,527	0.999688
11.6	62	0.00003	11.6061	134.70	1,563	18,144	0.999714
11.7	47	0.00002	11.7061	137.03	1,604	18,778	0.999734
11.8	58	0.00002	11.8061	139.38	1,646	19,428	0.999759
11.9	26	0.00001	11.9061	141.76	1,688	20,095	0.999770
12.0	54	0.00002	12.0061	144.15	1,731	20,778	0.999793
12.1	19	0.00001	12.1061	146.56	1,774	21,479	0.999801
12.2	35	0.00001	12.2061	148.99	1,819	22,198	0.999816
12.3	15	0.00001	12.3061	151.44	1,864	22,934	0.999823
12.4	26	0.00001	12.4061	153.91	1,909	23,689	0.999834
12.5	29	0.00001	12.5061	156.40	1,956	24,462	0.999846
12.6	14	0.00001	12.6061	158.91	2,003	25,254	0.999852
12.7	41	0.00002	12.7061	161.44	2,051	26,064	0.999870
12.8	17	0.00001	12.8061	164.00	2,100	26,895	0.999877
12.9	10	0.00000	12.9061	166.57	2,150	27,745	0.999881
13.0	32	0.00001	13.0061	169.16	2,200	28,615	0.999895
13.1	14	0.00001	13.1061	171.77	2,251	29,505	0.999901
13.2	19	0.00001	13.2061	174.40	2,303	30,416	0.999909
13.3	21	0.00001	13.3061	177.05	2,356	31,347	0.999918
13.4	6	0.00000	13.4061	179.72	2,409	32,301	0.999921
13.5	13	0.00001	13.5061	182.41	2,464	33,275	0.999926
13.6	12	0.00001	13.6061	185.13	2,519	34,272	0.999931
13.7	12	0.00001	13.7061	187.86	2,575	35,290	0.999936
13.8	11	0.00000	13.8061	190.61	2,632	36,332	0.999941
13.9	6	0.00000	13.9061	193.38	2,689	37,396	0.999944

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
14.0	19	0.000008	14.0005	196.01	2,744	38,421	0.999947
14.1	10	0.000004	14.1005	198.82	2,804	39,531	0.999951
14.2	13	0.000006	14.2005	201.65	2,864	40,664	0.999956
14.3	6	0.000003	14.3005	204.50	2,925	41,822	0.999959
14.4	8	0.000003	14.4005	207.37	2,986	43,004	0.999962
14.5	5	0.000002	14.5005	210.26	3,049	44,211	0.999965
14.6	8	0.000003	14.6005	213.17	3,112	45,443	0.999968
14.7	11	0.000005	14.7005	216.10	3,177	46,701	0.999973
14.8	5	0.000002	14.8005	219.05	3,242	47,985	0.999975
14.9	6	0.000003	14.9005	222.02	3,308	49,295	0.999977
15.0	8	0.000003	15.0005	225.01	3,375	50,632	0.999981
15.1	2	0.000001	15.1005	228.02	3,443	51,995	0.999982
15.2	3	0.000001	15.2005	231.05	3,512	53,386	0.999983
15.3	8	0.000003	15.3005	234.11	3,582	54,805	0.999986
15.4	2	0.000001	15.4005	237.18	3,653	56,252	0.999987
15.5	6	0.000003	15.5005	240.27	3,724	57,727	0.999990
15.6	3	0.000001	15.6005	243.38	3,797	59,232	0.999991
15.7	2	0.000001	15.7005	246.51	3,870	60,765	0.999992
15.8	4	0.000002	15.8005	249.66	3,945	62,328	0.999994
15.9	1	0.000000	15.9005	252.83	4,020	63,921	0.999994
16.0	4	0.000002	16.0005	256.02	4,096	65,544	0.999996
16.1	1	0.000000	16.1005	259.23	4,174	67,198	0.999996
16.2	2	0.000001	16.2005	262.46	4,252	68,883	0.999997
16.3	2	0.000001	16.3005	265.71	4,331	70,600	0.999998
16.4	1	0.000000	16.4005	268.98	4,411	72,348	0.999998
16.5	-	-	16.5005	272.27	4,493	74,129	0.999998
16.6	-	-	16.6005	275.58	4,575	75,942	0.999998
16.7	-	-	16.7005	278.91	4,658	77,789	0.999998
16.8	1	0.000000	16.8005	282.26	4,742	79,669	0.999999
16.9	-	-	16.9005	285.63	4,827	81,583	0.999999
17.0	1	0.000000	17.0005	289.02	4,913	83,531	0.999999
17.1	1	0.000000	17.1005	292.43	5,001	85,513	1.000000
17.2	-	-	17.2005	295.86	5,089	87,531	1.000000
17.3	1	0.000000	17.3005	299.31	5,178	89,585	1.000000
17.4	-	-	17.4005	302.78	5,268	91,674	1.000000
17.5	-	-	17.5005	306.27	5,360	93,800	1.000000

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
14.0	21	0.00001	14.0061	196.17	2,748	38,483	0.999953
14.1	12	0.00001	14.1061	198.98	2,807	39,594	0.999958
14.2	6	0.00000	14.2061	201.81	2,867	40,729	0.999960
14.3	6	0.00000	14.3061	204.66	2,928	41,888	0.999963
14.4	6	0.00000	14.4061	207.54	2,990	43,071	0.999965
14.5	7	0.00000	14.5061	210.43	3,052	44,279	0.999968
14.6	4	0.00000	14.6061	213.34	3,116	45,513	0.999970
14.7	3	0.00000	14.7061	216.27	3,180	46,772	0.999971
14.8	1	0.00000	14.8061	219.22	3,246	48,058	0.999972
14.9	6	0.00000	14.9061	222.19	3,312	49,369	0.999974
15.0	5	0.00000	15.0061	225.18	3,379	50,707	0.999976
15.1	2	0.00000	15.1061	228.19	3,447	52,073	0.999977
15.2	3	0.00000	15.2061	231.23	3,516	53,465	0.999979
15.3	6	0.00000	15.3061	234.28	3,586	54,886	0.999981
15.4	6	0.00000	15.4061	237.35	3,657	56,334	0.999984
15.5	4	0.00000	15.5061	240.44	3,728	57,811	0.999985
15.6	3	0.00000	15.6061	243.55	3,801	59,317	0.999987
15.7	2	0.00000	15.7061	246.68	3,874	60,852	0.999988
15.8	2	0.00000	15.8061	249.83	3,949	62,416	0.999988
15.9	3	0.00000	15.9061	253.00	4,024	64,011	0.999990
16.0	3	0.00000	16.0061	256.20	4,101	65,636	0.999991
16.1	1	0.00000	16.1061	259.41	4,178	67,292	0.999991
16.2	2	0.00000	16.2061	262.64	4,256	68,979	0.999992
16.3	4	0.00000	16.3061	265.89	4,336	70,697	0.999994
16.4	-	-	16.4061	269.16	4,416	72,447	0.999994
16.5	1	0.00000	16.5061	272.45	4,497	74,230	0.999994
16.6	3	0.00000	16.6061	275.76	4,579	76,045	0.999996
16.7	1	0.00000	16.7061	279.09	4,663	77,893	0.999996
16.8	1	0.00000	16.8061	282.44	4,747	79,775	0.999997
16.9	-	-	16.9061	285.82	4,832	81,691	0.999997
17.0	3	0.00000	17.0061	289.21	4,918	83,641	0.999998
17.1	1	0.00000	17.1061	292.62	5,006	85,626	0.999998
17.2	-	-	17.2061	296.05	5,094	87,645	0.999998
17.3	3	0.00000	17.3061	299.50	5,183	89,701	1.000000
17.4	-	-	17.4061	302.97	5,274	91,792	1.000000
17.5	1	0.00000	17.5061	306.46	5,365	93,920	1.000000

Red 7 and Hi-Low True Count Distributions
Six Decks, 4.5 decks dealt
10,000 Six deck shoes, 234 cards dealt per shoe

Red 7 True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
n/a	2,339,988	1.000000	0.0000	5.9607	0.1376	191.5614	

Mean(X) = μ = E(X) (0.0005)

E(X - μ)^2	5.9607	Normal Distribution
E(X - μ)^3	0.1376	Skew = 0 Kurtosis = 3
E(X - μ)^4	191.5614	

Var(X) = E(X - μ)^2	5.9607	
SD(X) = SQRT(Var(X))	2.4415	
Skew = E(X - μ)^3 / SD^3	0.0095	close to zero: unskewed
Kurtosis = E(X - μ)^4 / SD^4	5.3916	Kurtosis > 3: leptokurtic

Notes:

(a) 10,000 shoes with 234 cards dealt per shoe means that there would have been 2,340,000 hands if every hand was accounted for. There were only 2,339,988 hands recorded. Therefore there were 12 hands where either Red 7 true count > 17.55 or Red 7 true count < -17.55.

(b) There were no occurrences of Red 7 true counts of 2.1 or 1.9. This is because of Red 7 pivot at a true count of 2 and true counts covered by the intervals 2.1 and 1.9. For Red 7 true count interval 2.1, this corresponds to all Red 7 true counts in the interval [2.05,2.15), i.e. 2.05 <= Red 7 tc < 2.15, For Red 7 six decks: tc = 2 + (rc - 12)/dr. For true count interval 2.1 make (rc - 12) as small as possible and "dr" as large as possible and see if it falls in the interval. So let rc = 13 and let dr = 6 which would give the best chance of falling in the Red 7 tc = 2.1 interval. In this case tc = 2 + (13 - 12) / 6 = 2 + 1/6 = 2.167 which falls in the Red 7 tc = 2.2 interval. And if Red 7 = 12, then Red 7 tc = 2 and the true count is in the Red 7 tc = 2.0 interval. Thus the Red 7 tc = 2.1 interval is totally bypassed and has zero occurrences.

Hi-Low True Count Distribution

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low tc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
n/a	2,339,995	1.00000	0.0000	5.6689	0.1769	171.0353	

Mean(X) = μ = E(X) (0.0061)

E(X - μ)^2	5.6689	Normal Distribution
E(X - μ)^3	0.1769	Skew = 0 Kurtosis = 3
E(X - μ)^4	171.0353	

Var(X) = E(X - μ)^2	5.6689	
SD(X) = SQRT(Var(X))	2.3809	
Skew = E(X - μ)^3 / SD^3	0.0131	close to zero: unskewed
Kurtosis = E(X - μ)^4 / SD^4	5.3222	Kurtosis > 3: leptokurtic

Notes:

(a) 10,000 shoes with 234 cards dealt per shoe means that there would have been 2,340,000 hands if every hand was accounted for. There were only 2,339,995 hands recorded. Therefore there were 5 hands where either Hi-Low true count > 17.55 or Hi-Low true count < -17.55.

(b) There were no occurrences of Hi-Low true counts of 0.1 or -0.1. This is because of Hi-Low is balanced, i.e. has a pivot at true count of zero, and the true counts covered by the intervals 0.1 and -0.1. For Hi-Low true count interval 0.1 this corresponds to all Hi-Low true counts in the interval [0.05,0.15), i.e. 0.05 <= Hi-Low tc < 0.15. For Hi-Low, tc = rc/dr. For true count interval 0.1 make rc as small as possible and "dr" as large as possible and see if it falls in the interval. So let rc = 1 and let dr = 6 which would give the best chance of falling in the Hi-Low tc = 0.1 interval. In this case tc = 1/6 = 0.167 which falls in the Hi-Low tc = 0.2 interval. And if Hi-Low = 0, then Hi-Low tc = 0 and the true count is in the Hi-Low tc = 0 interval. Thus the Hi-Low tc = 0.1 interval is totally bypassed and has zero occurrences.

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-17.5	1	0.5	0.5	-17	3.5
-17.4	-	1	-	(-17.5,-16.5)	
-17.3	-	1	-		
-17.2	-	1	-	mean(X')	
-17.1	-	1	-	(16.8143)	mean > midpoint
-17.0	-	1	-		
-16.9	-	1	-		
-16.8	-	1	-		
-16.7	3	1	3.0		
-16.6	-	1	-		
-16.5	-	0.5	-		
-16.5	-	0.5	-	-16	9.5
-16.4	2	1	2.0	(-16.5,-15.5)	
-16.3	-	1	-		
-16.2	-	1	-	mean(X')	
-16.1	-	1	-	(15.9000)	mean > midpoint
-16.0	2	1	2.0		
-15.9	1	1	1.0		
-15.8	1	1	1.0		
-15.7	-	1	-		
-15.6	3	1	3.0		
-15.5	1	0.5	0.5		
-15.5	1	0.5	0.5	-15	35.0
-15.4	-	1	-	(-15.5,-14.5)	
-15.3	6	1	6.0		
-15.2	1	1	1.0	mean(X')	
-15.1	5	1	5.0	(14.8771)	mean > midpoint
-15.0	2	1	2.0		
-14.9	3	1	3.0		
-14.8	2	1	2.0		
-14.7	6	1	6.0		
-14.6	2	1	2.0		
-14.5	15	0.5	7.5		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-14.5	15	0.5	7.5	-14	91.0
-14.4	2	1	2.0	(-14.5,-13.5)	
-14.3	11	1	11.0		
-14.2	3	1	3.0	mean(X')	
-14.1	2	1	2.0	(13.9253)	mean > midpoint
-14.0	13	1	13.0		
-13.9	12	1	12.0		
-13.8	9	1	9.0		
-13.7	11	1	11.0		
-13.6	11	1	11.0		
-13.5	19	0.5	9.5		
-13.5	19	0.5	9.5	-13	219.5
-13.4	22	1	22.0	(-13.5,-12.5)	
-13.3	17	1	17.0		
-13.2	15	1	15.0	mean(X')	
-13.1	16	1	16.0	(12.9565)	mean > midpoint
-13.0	30	1	30.0		
-12.9	24	1	24.0		
-12.8	17	1	17.0		
-12.7	24	1	24.0		
-12.6	27	1	27.0		
-12.5	36	0.5	18.0		
-12.5	36	0.5	18.0	-12	427.5
-12.4	25	1	25.0	(-12.5,-11.5)	
-12.3	31	1	31.0		
-12.2	25	1	25.0	mean(X')	
-12.1	43	1	43.0	(11.9253)	mean > midpoint
-12.0	51	1	51.0		
-11.9	33	1	33.0		
-11.8	52	1	52.0		
-11.7	70	1	70.0		
-11.6	49	1	49.0		
-11.5	61	0.5	30.5		

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-11.5	61	0.5	30.5	-11	886.5
-11.4	43	1	43.0	(-11.5,-10.5)	
-11.3	125	1	125.0		
-11.2	49	1	49.0	mean(X')	
-11.1	64	1	64.0	(10.9389)	mean > midpoint
-11.0	107	1	107.0		
-10.9	84	1	84.0		
-10.8	73	1	73.0		
-10.7	135	1	135.0		
-10.6	112	1	112.0		
-10.5	128	0.5	64.0		
-10.5	128	0.5	64.0	-10	1,941.5
-10.4	164	1	164.0	(-10.5,-9.5)	
-10.3	110	1	110.0		
-10.2	137	1	137.0	mean(X')	
-10.1	149	1	149.0	(9.9320)	mean > midpoint
-10.0	262	1	262.0		
-9.9	157	1	157.0		
-9.8	272	1	272.0		
-9.7	235	1	235.0		
-9.6	314	1	314.0		
-9.5	155	0.5	77.5		
-9.5	155	0.5	77.5	-9	3,952.0
-9.4	338	1	338.0	(-9.5,-8.5)	
-9.3	344	1	344.0		
-9.2	292	1	292.0	mean(X')	
-9.1	436	1	436.0	(8.9380)	mean > midpoint
-9.0	293	1	293.0		
-8.9	461	1	461.0		
-8.8	417	1	417.0		
-8.7	539	1	539.0		
-8.6	443	1	443.0		
-8.5	623	0.5	311.5		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-8.5	623	0.5	311.5	-8	7,530.5
-8.4	600	1	600.0	(-8.5,-7.5)	
-8.3	576	1	576.0		
-8.2	563	1	563.0	mean(X')	
-8.1	593	1	593.0	(7.9460)	mean > midpoint
-8.0	849	1	849.0		
-7.9	873	1	873.0		
-7.8	964	1	964.0		
-7.7	654	1	654.0		
-7.6	1,030	1	1,030.0		
-7.5	1,034	0.5	517.0		
-7.5	1,034	0.5	517.0	-7	12,903.5
-7.4	768	1	768.0	(-7.5,-6.5)	
-7.3	1,164	1	1,164.0		
-7.2	1,203	1	1,203.0	mean(X')	
-7.1	1,263	1	1,263.0	(6.9495)	mean > midpoint
-7.0	1,250	1	1,250.0		
-6.9	1,347	1	1,347.0		
-6.8	1,297	1	1,297.0		
-6.7	1,839	1	1,839.0		
-6.6	1,406	1	1,406.0		
-6.5	1,699	0.5	849.5		
-6.5	1,699	0.5	849.5	-6	21,686.0
-6.4	1,499	1	1,499.0	(-6.5,-5.5)	
-6.3	1,745	1	1,745.0		
-6.2	1,873	1	1,873.0	mean(X')	
-6.1	1,883	1	1,883.0	(5.9484)	mean > midpoint
-6.0	2,520	1	2,520.0		
-5.9	2,196	1	2,196.0		
-5.8	2,530	1	2,530.0		
-5.7	2,602	1	2,602.0		
-5.6	2,714	1	2,714.0		
-5.5	2,549	0.5	1,274.5		

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-5.5	2,549	0.5	1,274.5	-5	39,939.5
-5.4	3,225	1	3,225.0	(-5.5,-4.5)	
-5.3	3,506	1	3,506.0		
-5.2	3,742	1	3,742.0	mean(X')	
-5.1	3,635	1	3,635.0	(4.9543)	mean > midpoint
-5.0	3,985	1	3,985.0		
-4.9	4,097	1	4,097.0		
-4.8	4,093	1	4,093.0		
-4.7	4,971	1	4,971.0		
-4.6	5,102	1	5,102.0		
-4.5	4,618	0.5	2,309.0		
-4.5	4,618	0.5	2,309.0	-4	68,659.5
-4.4	5,833	1	5,833.0	(-4.5,-3.5)	
-4.3	5,827	1	5,827.0		
-4.2	5,790	1	5,790.0	mean(X')	
-4.1	5,943	1	5,943.0	(3.9524)	mean > midpoint
-4.0	7,143	1	7,143.0		
-3.9	7,280	1	7,280.0		
-3.8	7,310	1	7,310.0		
-3.7	8,465	1	8,465.0		
-3.6	8,530	1	8,530.0		
-3.5	8,459	0.5	4,229.5		
-3.5	8,459	0.5	4,229.5	-3	121,170.0
-3.4	9,304	1	9,304.0	(-3.5,-2.5)	
-3.3	10,733	1	10,733.0		
-3.2	10,444	1	10,444.0	mean(X')	
-3.1	11,434	1	11,434.0	(2.9522)	mean > midpoint
-3.0	12,872	1	12,872.0		
-2.9	11,414	1	11,414.0		
-2.8	13,749	1	13,749.0		
-2.7	13,793	1	13,793.0		
-2.6	15,475	1	15,475.0		
-2.5	15,445	0.5	7,722.5		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
-2.5	15,445	0.5	7,722.5	-2	212,118.5
-2.4	17,266	1	17,266.0	(-2.5,-1.5)	
-2.3	17,414	1	17,414.0		
-2.2	18,205	1	18,205.0	mean(X')	
-2.1	19,266	1	19,266.0	(1.9519)	mean > midpoint
-2.0	21,030	1	21,030.0		
-1.9	23,833	1	23,833.0		
-1.8	22,613	1	22,613.0		
-1.7	24,144	1	24,144.0		
-1.6	26,913	1	26,913.0		
-1.5	27,424	0.5	13,712.0		
-1.5	27,424	0.5	13,712.0	-1	383,243.0
-1.4	28,936	1	28,936.0	(-1.5,-0.5)	
-1.3	35,052	1	35,052.0		
-1.2	31,928	1	31,928.0	mean(X')	
-1.1	34,599	1	34,599.0	(0.9496)	mean > midpoint
-1.0	38,299	1	38,299.0		
-0.9	38,952	1	38,952.0		
-0.8	42,808	1	42,808.0		
-0.7	44,620	1	44,620.0		
-0.6	49,026	1	49,026.0		
-0.5	50,622	0.5	25,311.0		
-0.5	50,622	0.5	25,311.0	0	591,741.5
-0.4	57,134	1	57,134.0	(-0.5,0.5)	
-0.3	55,103	1	55,103.0		
-0.2	65,816	1	65,816.0	mean(X')	
-0.1	58,290	1	58,290.0	(0.0011)	mean ≈ midpoint
0.0	65,415	1	65,415.0		
0.1	66,836	1	66,836.0		
0.2	59,061	1	59,061.0		
0.3	61,339	1	61,339.0		
0.4	52,277	1	52,277.0		
0.5	50,319	0.5	25,159.5		

Exhibit F1d

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
0.5	50,319	0.5	25,159.5	1	382,893.5
0.6	48,673	1	48,673.0	(0.5,1.5)	
0.7	44,227	1	44,227.0		
0.8	43,177	1	43,177.0	mean(X')	
0.9	42,045	1	42,045.0	0.9504	mean < midpoint
1.0	35,747	1	35,747.0		
1.1	35,792	1	35,792.0		
1.2	30,912	1	30,912.0		
1.3	28,493	1	28,493.0		
1.4	34,594	1	34,594.0		
1.5	28,148	0.5	14,074.0		
1.5	28,148	0.5	14,074.0	2	210,188.0
1.6	29,610	1	29,610.0	(1.5,2.5)	
1.7	22,520	1	22,520.0		
1.8	19,408	1	19,408.0	mean(X')	
1.9	-	1	-	1.9514	mean < midpoint
2.0	67,913	1	67,913.0		
2.1	-	1	-		
2.2	12,056	1	12,056.0		
2.3	18,426	1	18,426.0		
2.4	17,297	1	17,297.0		
2.5	17,768	0.5	8,884.0		
2.5	17,768	0.5	8,884.0	3	121,507.0
2.6	17,074	1	17,074.0	(2.5,3.5)	
2.7	12,932	1	12,932.0		
2.8	11,716	1	11,716.0	mean(X')	
2.9	12,092	1	12,092.0	2.9477	mean < midpoint
3.0	11,579	1	11,579.0		
3.1	12,048	1	12,048.0		
3.2	11,132	1	11,132.0		
3.3	11,177	1	11,177.0		
3.4	8,717	1	8,717.0		
3.5	8,312	0.5	4,156.0		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
3.5	8,312	0.5	4,156.0	4	69,447.5
3.6	8,219	1	8,219.0	(3.5,4.5)	
3.7	8,335	1	8,335.0		
3.8	7,989	1	7,989.0	mean(X')	
3.9	7,515	1	7,515.0	3.9545	mean < midpoint
4.0	7,343	1	7,343.0		
4.1	6,049	1	6,049.0		
4.2	5,943	1	5,943.0		
4.3	5,719	1	5,719.0		
4.4	5,423	1	5,423.0		
4.5	5,513	0.5	2,756.5		
4.5	5,513	0.5	2,756.5	5	39,230.0
4.6	5,114	1	5,114.0	(4.5,5.5)	
4.7	4,343	1	4,343.0		
4.8	4,097	1	4,097.0	mean(X')	
4.9	3,852	1	3,852.0	4.9528	mean < midpoint
5.0	3,823	1	3,823.0		
5.1	3,733	1	3,733.0		
5.2	3,204	1	3,204.0		
5.3	3,984	1	3,984.0		
5.4	2,909	1	2,909.0		
5.5	2,829	0.5	1,414.5		
5.5	2,829	0.5	1,414.5	6	22,563.5
5.6	2,806	1	2,806.0	(5.5,6.5)	
5.7	2,444	1	2,444.0		
5.8	2,344	1	2,344.0	mean(X')	
5.9	2,779	1	2,779.0	5.9536	mean < midpoint
6.0	2,392	1	2,392.0		
6.1	1,948	1	1,948.0		
6.2	1,971	1	1,971.0		
6.3	1,921	1	1,921.0		
6.4	1,737	1	1,737.0		
6.5	1,614	0.5	807.0		

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
6.5	1,614	0.5	807.0	7	12,902.0
6.6	1,829	1	1,829.0	(6.5,7.5)	
6.7	1,481	1	1,481.0		
6.8	1,388	1	1,388.0	mean(X')	
6.9	1,100	1	1,100.0	6.9466	mean < midpoint
7.0	1,404	1	1,404.0		
7.1	1,267	1	1,267.0		
7.2	1,058	1	1,058.0		
7.3	1,262	1	1,262.0		
7.4	916	1	916.0		
7.5	780	0.5	390.0		
7.5	780	0.5	390.0	8	6,889.0
7.6	863	1	863.0	(7.5,8.5)	
7.7	832	1	832.0		
7.8	776	1	776.0	mean(X')	
7.9	770	1	770.0	7.9503	mean < midpoint
8.0	790	1	790.0		
8.1	517	1	517.0		
8.2	546	1	546.0		
8.3	621	1	621.0		
8.4	596	1	596.0		
8.5	376	0.5	188.0		
8.5	376	0.5	188.0	9	3,949.0
8.6	533	1	533.0	(8.5,9.5)	
8.7	550	1	550.0		
8.8	357	1	357.0	mean(X')	
8.9	392	1	392.0	8.9553	mean < midpoint
9.0	372	1	372.0		
9.1	349	1	349.0		
9.2	415	1	415.0		
9.3	390	1	390.0		
9.4	300	1	300.0		
9.5	206	0.5	103.0		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
9.5	206	0.5	103.0	10	1,964.5
9.6	252	1	252.0	(9.5,10.5)	
9.7	240	1	240.0		
9.8	235	1	235.0	mean(X')	
9.9	216	1	216.0	9.9401	mean < midpoint
10.0	258	1	258.0		
10.1	159	1	159.0		
10.2	158	1	158.0		
10.3	170	1	170.0		
10.4	100	1	100.0		
10.5	147	0.5	73.5		
10.5	147	0.5	73.5	11	995.0
10.6	117	1	117.0	(10.5,11.5)	
10.7	160	1	160.0		
10.8	104	1	104.0	mean(X')	
10.9	107	1	107.0	10.9190	mean < midpoint
11.0	98	1	98.0		
11.1	98	1	98.0		
11.2	85	1	85.0		
11.3	83	1	83.0		
11.4	40	1	40.0		
11.5	59	0.5	29.5		
11.5	59	0.5	29.5	12	470.5
11.6	71	1	71.0	(11.5,12.5)	
11.7	35	1	35.0		
11.8	59	1	59.0	mean(X')	
11.9	57	1	57.0	11.9455	mean < midpoint
12.0	63	1	63.0		
12.1	37	1	37.0		
12.2	22	1	22.0		
12.3	36	1	36.0		
12.4	39	1	39.0		
12.5	44	0.5	22.0		

Calculation of Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
12.5	44	0.5	22.0	13	225.5
12.6	14	1	14.0	(12.5,13.5)	
12.7	34	1	34.0		
12.8	22	1	22.0	mean(X')	
12.9	24	1	24.0	12.9616	mean < midpoint
13.0	16	1	16.0		
13.1	17	1	17.0		
13.2	29	1	29.0		
13.3	21	1	21.0		
13.4	21	1	21.0		
13.5	11	0.5	5.5		
13.5	11	0.5	5.5	14	119.0
13.6	14	1	14.0	(13.5,14.5)	
13.7	16	1	16.0		
13.8	14	1	14.0	mean(X')	
13.9	11	1	11.0	13.9395	mean < midpoint
14.0	19	1	19.0		
14.1	10	1	10.0		
14.2	13	1	13.0		
14.3	6	1	6.0		
14.4	8	1	8.0		
14.5	5	0.5	2.5		
14.5	5	0.5	2.5	15	58.5
14.6	8	1	8.0	(14.5,15.5)	
14.7	11	1	11.0		
14.8	5	1	5.0	mean(X')	
14.9	6	1	6.0	14.9342	mean < midpoint
15.0	8	1	8.0		
15.1	2	1	2.0		
15.2	3	1	3.0		
15.3	8	1	8.0		
15.4	2	1	2.0		
15.5	6	0.5	3.0		

X					
Red 7 tc	Hand Freq	Factor	Hand Freq	X'	Hand Freq'
15.5	6	0.5	3.0	16	23.0
15.6	3	1	3.0	(15.5,16.5)	
15.7	2	1	2.0		
15.8	4	1	4.0	mean(X')	
15.9	1	1	1.0	15.8826	mean < midpoint
16.0	4	1	4.0		
16.1	1	1	1.0		
16.2	2	1	2.0		
16.3	2	1	2.0		
16.4	1	1	1.0		
16.5	-	0.5	-		
16.5	-	0.5	-	17	4.0
16.6	-	1	-	(16.5,17.5)	
16.7	-	1	-		
16.8	1	1	1.0	mean(X')	
16.9	-	1	-	17.0500	mean > midpoint?
17.0	1	1	1.0		not enough data
17.1	1	1	1.0		
17.2	-	1	-		
17.3	1	1	1.0		
17.4	-	1	-		
17.5	-	0.5	-		

Red 7 Hand Frequency
by Red 7 True Count Integer
Six Decks, 4.5 decks dealt

Red 7 True Count	Interval mean	Hand Freq	Hand %
-17	-16.8143	3.5	0.00%
-16	-15.9000	9.5	0.00%
-15	-14.8771	35.0	0.00%
-14	-13.9253	91.0	0.00%
-13	-12.9565	219.5	0.01%
-12	-11.9253	427.5	0.02%
-11	-10.9389	886.5	0.04%
-10	-9.9320	1,941.5	0.08%
-9	-8.9380	3,952.0	0.17%
-8	-7.9460	7,530.5	0.32%
-7	-6.9495	12,903.5	0.55%
-6	-5.9484	21,686.0	0.93%
-5	-4.9543	39,939.5	1.71%
-4	-3.9524	68,659.5	2.93%
-3	-2.9522	121,170.0	5.18%
-2	-1.9519	212,118.5	9.06%
-1	-0.9496	383,243.0	16.38%
0	-0.0011	591,741.5	25.29%
1	0.9504	382,893.5	16.36%
2	1.9514	210,188.0	8.98%
3	2.9477	121,507.0	5.19%
4	3.9545	69,447.5	2.97%
5	4.9528	39,230.0	1.68%
6	5.9536	22,563.5	0.96%
7	6.9466	12,902.0	0.55%
8	7.9503	6,889.0	0.29%
9	8.9553	3,949.0	0.17%
10	9.9401	1,964.5	0.08%
11	10.9190	995.0	0.04%
12	11.9455	470.5	0.02%
13	12.9616	225.5	0.01%
14	13.9395	119.0	0.01%
15	14.9342	58.5	0.00%
16	15.8826	23.0	0.00%
17	17.0500	4.0	0.00%
Total	n/a	2,339,987.5	100.00%

Red 7 True Count >= 2

(Compare to Exhibit F1b)

X = Red 7 True Count	(A) Hand Freq	(B) Hand %	Y = (B) / (B:prev)	Y:LSL = m*X + b
2	210,188.0	42.85%	n/a	n/a
3	121,507.0	24.77%	0.5781	0.6238
4	69,447.5	14.16%	0.5716	0.6062
5	39,230.0	8.00%	0.5649	0.5886
6	22,563.5	4.60%	0.5752	0.5711
7	12,902.0	2.63%	0.5718	0.5535
8	6,889.0	1.40%	0.5339	0.5359
9	3,949.0	0.81%	0.5732	0.5183
10	1,964.5	0.40%	0.4975	0.5007
11	995.0	0.20%	0.5065	0.4832
12	470.5	0.10%	0.4729	0.4656
13	225.5	0.05%	0.4793	0.4480
14	119.0	0.02%	0.5277	0.4304
15	58.5	0.01%	0.4916	0.4128
16	23.0	0.00%	0.3932	0.3953
17	4.0	0.00%	0.1739	0.3777
Total	490,536.0	100.00%	n/a	n/a
	CORREL(Y,X) = CC		-75.3%	
	SLOPE(Y,X) = m		-0.0176	
	INTERCEPT(Y,X) = b		0.6765	

Comparison of Red 7 and Hi-Low
Standard Deviations

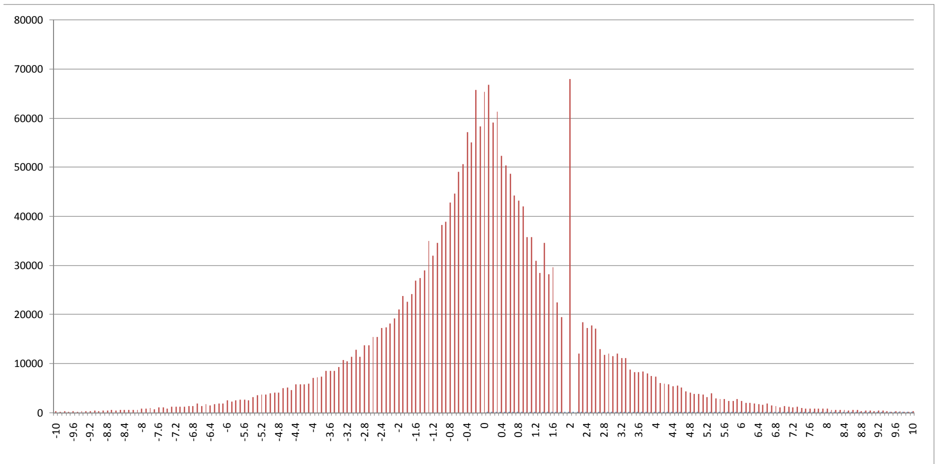
A = Six Decks, 4.5 decks dealt
True Count Standard Deviations
B = Standard Deviations from Exhibit K3

	Standard Deviations		
	Red 7	Hi-Low	R7 / HL
A	2.4415	2.3809	1.0254
B	0.8979	0.8771	1.0238

Red 7 True Count Frequency Distribution

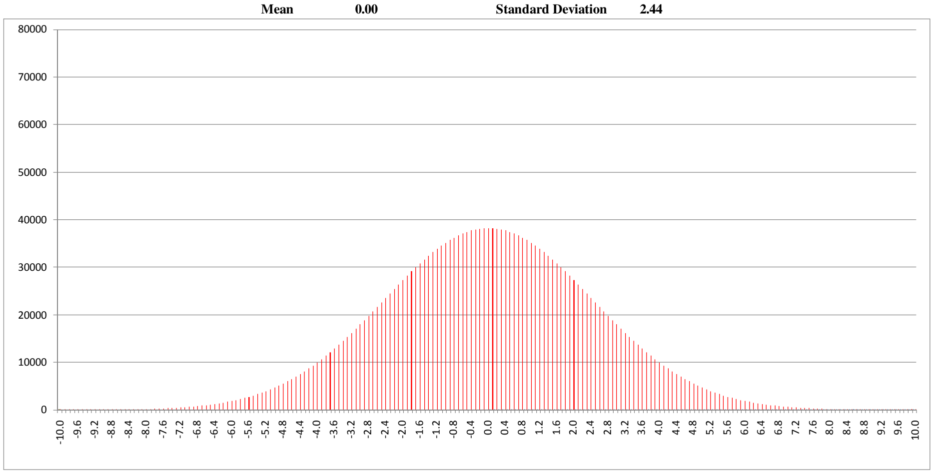
10,000 Six Decks, 4.5 Decks Dealt Simulation

Mean:	0.00	Skew:	0.01 (unskewed)
Standard Deviation:	2.44	Kurtosis:	5.39 (leptokurtic. Normal Distribution has a Kurtosis of 3)
Cards dealt per shoe	234	Total Cards Dealt ≈	2,340,000
# tc: -10 <= tc <= 10	2,335,135	% of distribution	99.8%



Normal Approximation

Mean **0.00** **Standard Deviation** **2.44**



Sample Red 7 true count frequencies

Red 7 true counts shown below in intervals of 0.10. Red 7 tc = "t" means Red 7 tc is in the interval (t-0.05, t+0.05)

Red 7 tc	Hand Freq	Norm App	Difference
-10.0	262	9	253
-9.5	155	20	135
-9.0	293	43	250
-8.5	623	89	534
-8.0	849	178	671
-7.5	1,034	342	692
-7.0	1,250	628	622
-6.5	1,699	1,106	593
-6.0	2,520	1,868	652
-5.5	2,549	3,025	(476)
-5.0	3,985	4,699	(714)
-4.5	4,618	6,999	(2,381)
-4.0	7,143	9,995	(2,852)
-3.5	8,459	13,689	(5,230)

Red 7 tc	Hand Freq	Norm App	Difference
-3.0	12,872	17,978	(5,106)
-2.5	15,445	22,640	(7,195)
-2.0	21,030	27,341	(6,311)
-1.5	27,424	31,662	(4,238)
-1.0	38,299	35,161	3,138
-0.5	50,622	37,442	13,180
0.0	65,415	38,234	27,181
0.5	50,319	37,439	12,880
1.0	35,747	35,155	592
1.5	28,148	31,655	(3,507)
2.0	67,913	27,332	40,581
2.5	17,768	22,631	(4,863)
3.0	11,579	17,969	(6,390)
3.5	8,312	13,681	(5,369)

Red 7 tc	Hand Freq	Norm App	Difference
4.0	7,343	9,989	(2,646)
4.5	5,513	6,993	(1,480)
5.0	3,823	4,695	(872)
5.5	2,829	3,023	(194)
6.0	2,392	1,866	526
6.5	1,614	1,105	509
7.0	1,404	627	777
7.5	780	341	439
8.0	790	178	612
8.5	376	89	287
9.0	372	43	329
9.5	206	20	186
10.0	258	9	249

Normal Approximation Red 7 true count interval "t" = { NORMDIST(t+0.05,mean,std dev,TRUE) - NORMDIST(t-0.05,mean,std dev,TRUE) } * {total cards dealt}

The normal approximation underestimates the Red 7 true count frequencies for Red 7 true counts less than -6 and greater than + 6 and also underestimates Red 7 true count frequencies for Red 7 true counts between -1 and +1. And for Red 7 true count between +1.5 and +5.5 and between -1.5 and -5.5, the normal approximation overestimates the Red 7 true count frequency (except for the spike at the Red 7 pivot point which is a Red 7 true count of +2). So there are less Red 7 true counts of 2, 3, 4 and 5 than would be the case if the Red 7 true count were normal distributed, but to compensate for this, there are more Red 7 true counts greater than or equal to 6 than would be the case if the Red 7 true count distribution were normally distributed.

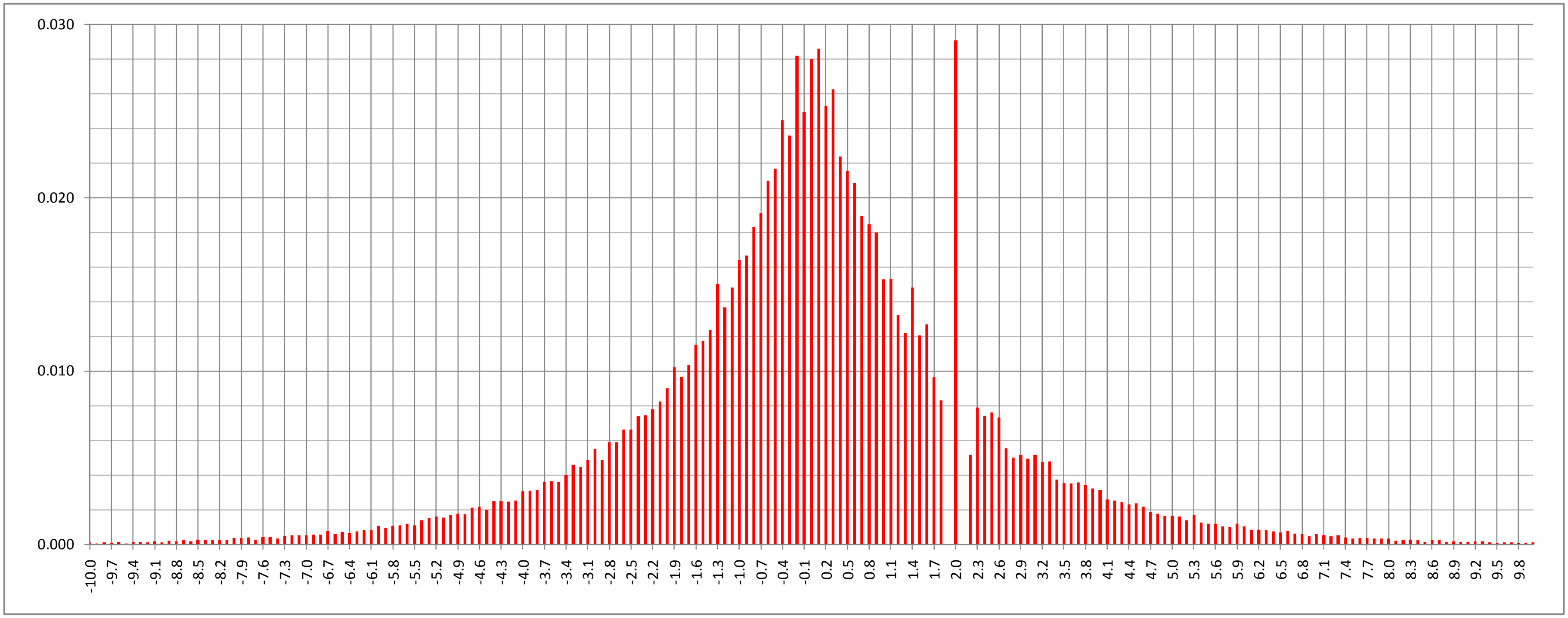
The Red 7 true count frequency distribution is leptokurtic. The distribution can be thought of as being constructed from the Normal Distribution by "squeezing" the Normal Distribution between -2 and -5 and between +2 and +5 and the displaced frequencies "popping up" between -1 and +1 and "spread out" at greater than or equal to +6 and less than or equal to -6.

Red 7 True Count (PDF) Probability Density Function

10,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Truncated Distributed: -10 <= Red 7 True Count <= +10

f(x) = Prob(x - 0.05 < Red 7 True Count < x + 0.05) = Prob(x - 0.05 < X < x + 0.05), "x" in tenths



Red 7 True Count (PDF) Probability Density Function

10,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Truncated Distributed: -10 <= Red 7 True Count <= +10

f(x) = Prob(x - 0.05 < Red 7 True Count < x + 0.05) = Prob(x - 0.05 < X < x + 0.05), "x" in tenths

X = Red 7 True Count, Six Decks, 4.5 Decks Dealt. f(x) = P(x - 0.05 < X < x + 0.05), "x" in tenths

x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)
-10.0	0.00011	-7.7	0.00028	-5.4	0.00138	-3.1	0.00490	-0.8	0.01833	1.5	0.01205	3.8	0.00342	6.1	0.00083	8.4	0.00026
-9.9	0.00007	-7.6	0.00044	-5.3	0.00150	-3.0	0.00551	-0.7	0.01911	1.6	0.01268	3.9	0.00322	6.2	0.00084	8.5	0.00016
-9.8	0.00012	-7.5	0.00044	-5.2	0.00160	-2.9	0.00489	-0.6	0.02099	1.7	0.00964	4.0	0.00314	6.3	0.00082	8.6	0.00023
-9.7	0.00010	-7.4	0.00033	-5.1	0.00156	-2.8	0.00589	-0.5	0.02168	1.8	0.00831	4.1	0.00259	6.4	0.00074	8.7	0.00024
-9.6	0.00013	-7.3	0.00050	-5.0	0.00171	-2.7	0.00591	-0.4	0.02447	1.9	-	4.2	0.00255	6.5	0.00069	8.8	0.00015
-9.5	0.00007	-7.2	0.00052	-4.9	0.00175	-2.6	0.00663	-0.3	0.02360	**2.0**	**0.02908**	4.3	0.00245	6.6	0.00078	8.9	0.00017
-9.4	0.00014	-7.1	0.00054	-4.8	0.00175	-2.5	0.00661	-0.2	0.02819	2.1	-	4.4	0.00232	6.7	0.00063	9.0	0.00016
-9.3	0.00015	-7.0	0.00054	-4.7	0.00213	-2.4	0.00739	-0.1	0.02496	2.2	0.00516	4.5	0.00236	6.8	0.00059	9.1	0.00015
-9.2	0.00013	-6.9	0.00058	-4.6	0.00218	-2.3	0.00746	0.0	0.02801	2.3	0.00789	4.6	0.00219	6.9	0.00047	9.2	0.00018
-9.1	0.00019	-6.8	0.00056	-4.5	0.00198	-2.2	0.00780	0.1	0.02862	2.4	0.00741	4.7	0.00186	7.0	0.00060	9.3	0.00017
-9.0	0.00013	-6.7	0.00079	-4.4	0.00250	-2.1	0.00825	0.2	0.02529	2.5	0.00761	4.8	0.00175	7.1	0.00054	9.4	0.00013
-8.9	0.00020	-6.6	0.00060	-4.3	0.00250	-2.0	0.00901	0.3	0.02627	2.6	0.00731	4.9	0.00165	7.2	0.00045	9.5	0.00009
-8.8	0.00018	-6.5	0.00073	-4.2	0.00248	-1.9	0.01021	0.4	0.02239	2.7	0.00554	5.0	0.00164	7.3	0.00054	9.6	0.00011
-8.7	0.00023	-6.4	0.00064	-4.1	0.00255	-1.8	0.00968	0.5	0.02155	2.8	0.00502	5.1	0.00160	7.4	0.00039	9.7	0.00010
-8.6	0.00019	-6.3	0.00075	-4.0	0.00306	-1.7	0.01034	0.6	0.02084	2.9	0.00518	5.2	0.00137	7.5	0.00033	9.8	0.00010
-8.5	0.00027	-6.2	0.00080	-3.9	0.00312	-1.6	0.01153	0.7	0.01894	3.0	0.00496	5.3	0.00171	7.6	0.00037	9.9	0.00009
-8.4	0.00026	-6.1	0.00081	-3.8	0.00313	-1.5	0.01174	0.8	0.01849	3.1	0.00516	5.4	0.00125	7.7	0.00036	10.0	0.00011
-8.3	0.00025	-6.0	0.00108	-3.7	0.00363	-1.4	0.01239	0.9	0.01801	3.2	0.00477	5.5	0.00121	7.8	0.00033		
-8.2	0.00024	-5.9	0.00094	-3.6	0.00365	-1.3	0.01501	1.0	0.01531	3.3	0.00479	5.6	0.00120	7.9	0.00033		
-8.1	0.00025	-5.8	0.00108	-3.5	0.00362	-1.2	0.01367	1.1	0.01533	3.4	0.00373	5.7	0.00105	8.0	0.00034		
-8.0	0.00036	-5.7	0.00111	-3.4	0.00398	-1.1	0.01482	1.2	0.01324	3.5	0.00356	5.8	0.00100	8.1	0.00022		
-7.9	0.00037	-5.6	0.00116	-3.3	0.00460	-1.0	0.01640	1.3	0.01220	3.6	0.00352	5.9	0.00119	8.2	0.00023		
-7.8	0.00041	-5.5	0.00109	-3.2	0.00447	-0.9	0.01668	1.4	0.01481	3.7	0.00357	6.0	0.00102	8.3	0.00027		

Red 7 True Count (CDF) Cumulative Distribution Function

10,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Truncated Distributed: -10 <= Red 7 True Count <= +10

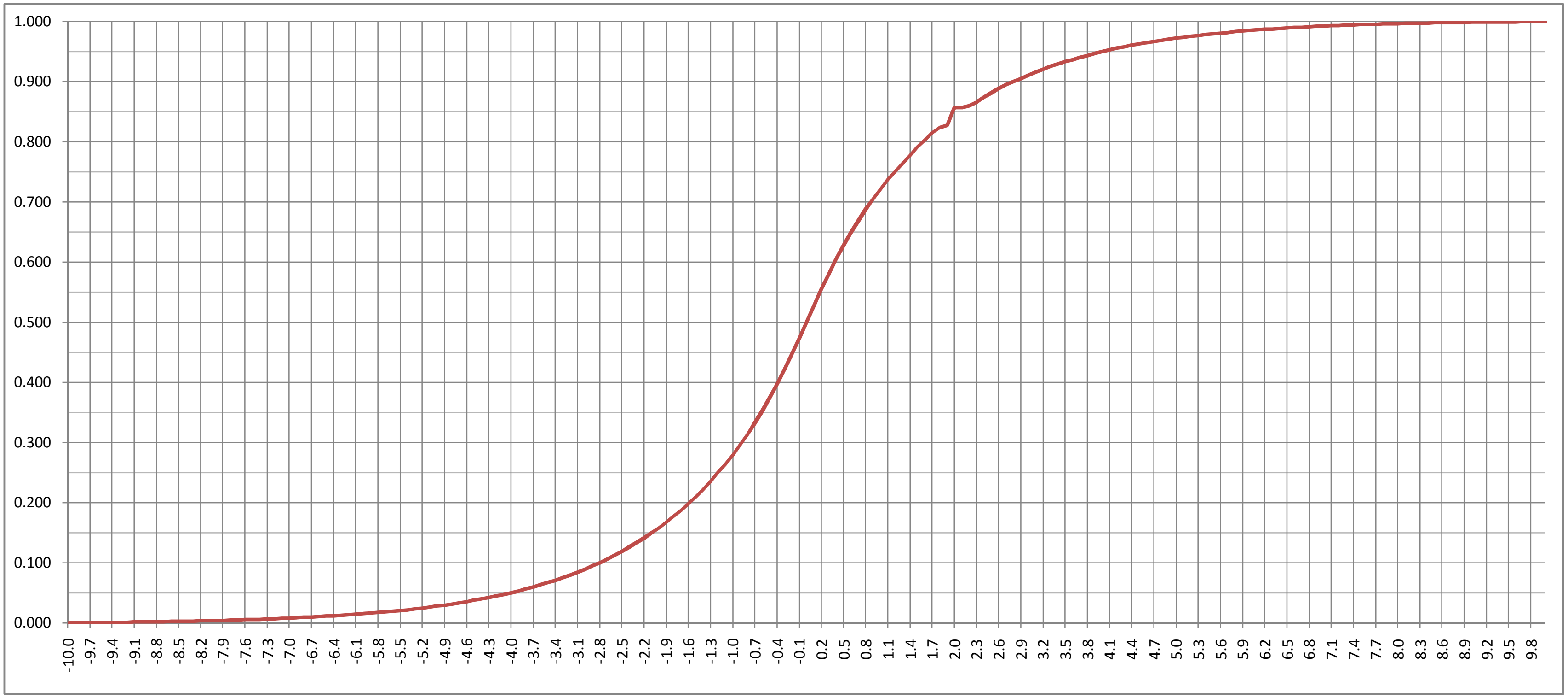
G(x) = Prob(X <= x)

X = Red 7 True Count

F(x) = Summation { f(k) } from k = -∞ to x
f(x) = P(x - 0.05 < X < x + 0.05)
Therefore: F(x) = P(X < x + 0.05):
(not an easy CDF to use)

Define: G(x) = P(X <= x)
Then G(x) is approximated by:
(1) G(x) = Average(F(x), F(x - 0.10)), x ≠ 2
(2) G(x) = F(x), x = 2

<u>Example:</u>
G(1.00) = Average(F(1.00), F(0.90))
G(1.00) = P (X <= 1.00) since
F(1.00) = P(X < 1.05) and F(0.90) = P(X < 0.95)



Red 7 True Count (CDF) Cumulative Distribution Function

10,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Truncated Distributed: -10 <= Red 7 True Count <= +10

G(x) = Prob(X <= x)

X = Red 7 True Count, Six Decks, 4.5 Decks Dealt. G(x) = P(X <= x), "x" in tenths

x	G(x)	x	G(x)	x	G(x)	x	G(x)	x	G(x)	x	G(x)	x	G(x)	x	G(x)	x	G(x)
-10.0	0.000	-7.7	0.005	-5.4	0.022	-3.1	0.084	-0.8	0.314	1.5	0.791	3.8	0.944	6.1	0.986	8.4	0.998
-9.9	0.000	-7.6	0.005	-5.3	0.023	-3.0	0.089	-0.7	0.332	1.6	0.803	3.9	0.947	6.2	0.987	8.5	0.998
-9.8	0.000	-7.5	0.005	-5.2	0.025	-2.9	0.095	-0.6	0.352	1.7	0.815	4.0	0.950	6.3	0.988	8.6	0.998
-9.7	0.000	-7.4	0.006	-5.1	0.026	-2.8	0.100	-0.5	0.374	1.8	0.824	4.1	0.953	6.4	0.989	8.7	0.998
-9.6	0.000	-7.3	0.006	-5.0	0.028	-2.7	0.106	-0.4	0.397	1.9	0.828	4.2	0.956	6.5	0.989	8.8	0.998
-9.5	0.001	-7.2	0.007	-4.9	0.029	-2.6	0.112	-0.3	0.421	**2.0**	**0.857**	4.3	0.958	6.6	0.990	8.9	0.999
-9.4	0.001	-7.1	0.007	-4.8	0.031	-2.5	0.119	-0.2	0.447	2.1	0.857	4.4	0.960	6.7	0.991	9.0	0.999
-9.3	0.001	-7.0	0.008	-4.7	0.033	-2.4	0.126	-0.1	0.473	2.2	0.859	4.5	0.963	6.8	0.991	9.1	0.999
-9.2	0.001	-6.9	0.008	-4.6	0.035	-2.3	0.133	0.0	0.500	2.3	0.866	4.6	0.965	6.9	0.992	9.2	0.999
-9.1	0.001	-6.8	0.009	-4.5	0.037	-2.2	0.141	0.1	0.528	2.4	0.874	4.7	0.967	7.0	0.992	9.3	0.999
-9.0	0.001	-6.7	0.010	-4.4	0.040	-2.1	0.149	0.2	0.555	2.5	0.881	4.8	0.969	7.1	0.993	9.4	0.999
-8.9	0.001	-6.6	0.010	-4.3	0.042	-2.0	0.157	0.3	0.581	2.6	0.888	4.9	0.971	7.2	0.993	9.5	0.999
-8.8	0.002	-6.5	0.011	-4.2	0.045	-1.9	0.167	0.4	0.605	2.7	0.895	5.0	0.972	7.3	0.994	9.6	1.000
-8.7	0.002	-6.4	0.012	-4.1	0.047	-1.8	0.177	0.5	0.627	2.8	0.900	5.1	0.974	7.4	0.994	9.7	1.000
-8.6	0.002	-6.3	0.012	-4.0	0.050	-1.7	0.187	0.6	0.648	2.9	0.905	5.2	0.975	7.5	0.995	9.8	1.000
-8.5	0.002	-6.2	0.013	-3.9	0.053	-1.6	0.198	0.7	0.668	3.0	0.910	5.3	0.977	7.6	0.995	9.9	1.000
-8.4	0.003	-6.1	0.014	-3.8	0.056	-1.5	0.210	0.8	0.687	3.1	0.915	5.4	0.978	7.7	0.996	10.0	1.000
-8.3	0.003	-6.0	0.015	-3.7	0.060	-1.4	0.222	0.9	0.705	3.2	0.920	5.5	0.980	7.8	0.996		
-8.2	0.003	-5.9	0.016	-3.6	0.063	-1.3	0.235	1.0	0.722	3.3	0.925	5.6	0.981	7.9	0.996		
-8.1	0.003	-5.8	0.017	-3.5	0.067	-1.2	0.250	1.1	0.737	3.4	0.929	5.7	0.982	8.0	0.997		
-8.0	0.004	-5.7	0.018	-3.4	0.071	-1.1	0.264	1.2	0.751	3.5	0.933	5.8	0.983	8.1	0.997		
-7.9	0.004	-5.6	0.019	-3.3	0.075	-1.0	0.279	1.3	0.764	3.6	0.937	5.9	0.984	8.2	0.997		
-7.8	0.004	-5.5	0.020	-3.2	0.079	-0.9	0.296	1.4	0.778	3.7	0.940	6.0	0.985	8.3	0.997	**f(2)**	**0.029**

Examples (Compare with Cumulative Red 7 Running Count examples)

Prob(Red 7 True Count >= 2) = P(X >= 2) = P(X = 2) + P(X > 2)

f(2) = P(1.95 < X < 2.05) = P(X = 2)   P(X > 2) = 1.0 - P(X <= 2) = 1.0 - G(2)

f(2) = 0.029   G(2.0) = 0.857

Therefore, Prob(Red 7 True Count >= 2) ≈ 0.029 + (1.000 - 0.857) = 17.2%

Prob(3 <= Red 7 True Count <= 4) = Prob(3 <= X <= 4)

= G(4.0) - G(3.0) = 0.95 - 0.91 = 4.0%

Prob(3 <= Red 7 True Count <= 4 given Red 7 True Count >= 2) = Prob(3 <= X <= 4 given X >= 2) = Prob(3 <= X <= 4) / P(X >= 2)

= 0.04 / 0.172 = 23.1%

Red 7 Hand Frequency
10,000 Six Decks, 4.5 Decks Dealt Simulation

Red 7 True Count >= -1

Leave Table if Red 7 true count < -1

Red 7 "tc"	Hand Freq	Hand %	Back count	Play	% Play at "tc"
-1	383,243	20.8%	20.8%	n/a	n/a
0	591,742	32.0%	32.0%	n/a	n/a
1	382,894	20.7%	20.7%	n/a	n/a
2	210,188	11.4%	n/a	11.4%	43.0%
3	121,507	6.6%	n/a	6.6%	24.9%
4	69,448	3.8%	n/a	3.8%	14.2%
5	39,230	2.1%	n/a	2.1%	8.0%
6	22,564	1.2%	n/a	1.2%	4.6%
7	12,902	0.7%	n/a	0.7%	2.6%
8	6,889	0.4%	n/a	0.4%	1.4%
9	3,949	0.2%	n/a	0.2%	0.8%
10	1,965	0.1%	n/a	0.1%	0.4%
Total	1,846,519	100.0%	73.5%	26.5%	100.0%

When actively back counting a table (true count does not drop to less than -1), around ¾th
the time the table would be back counted and around ¼th of the time the table will be played.

These calculations can also be done directly from Cumulative Red 7 True Count Distribution Function (CDF).
The Red 7 True Counts are rounded to the nearest integer in the above table. So a Red 7 true count >= -1 really
means Red 7 True Count >= -1.5 since Integer Red 7 True Count = -1 comprises the true count interval (-1.5,-0.5).
So Prob(Integer Red 7 true count >= -1) means Prob(Red 7 True Count >= -1.5).
P(Int Red 7 tc >= 2) / P(Int Red 7 tc >= -1)
= P(X >= 1.5) / P(X >= -1.5):

G(1.5) =	79.1%	P(X <= 1.5)
1.000 - G(1.5) =	20.9%	P(X > 1.5)
G(-1.5) =	21.0%	P(X <= -1.5)
1.000 - G(-1.5) =	79.0%	P(X > -1.5)

P(X > 1.5) / P(X > -1.5) = 0.209 / 0.79 = 26.4%
which is in good agreement with 26.5% from the table above.

If X were required to be greater than or equal to -1 and +2 respectively, without integer rounding, then the answer would be:
P(X >= 2) / P(X >= -1) :

f(2) =	2.9%	P(-1.95 < X < 2.05) = P(X = 2)
G(2) =	85.7%	P(X <= 2)
1.000 - G(2) =	14.3%	P(X > 2)
P(X >= 2) ≈	17.2%	= 0.029 + 0.143
G(-1) =	27.9%	P(X <= -1)
1.000 - G(-1) =	72.1%	P(X > -1)

P(X >= 2) / P(X >= -1) ≈ 0.172 / 0.721 = 23.9%

Another example: Prob(Int Red 7 tc = 2 given Int Red 7 tc >= 2) = ?
P(Int Red 7 tc = 2 given Int Red 7 tc >= 2) = P(Int Red 7 tc = 2) / P(Int Red 7 tc >= 2)
= P(1.5 <= X <= 2.5) / P(X >= 1.5)

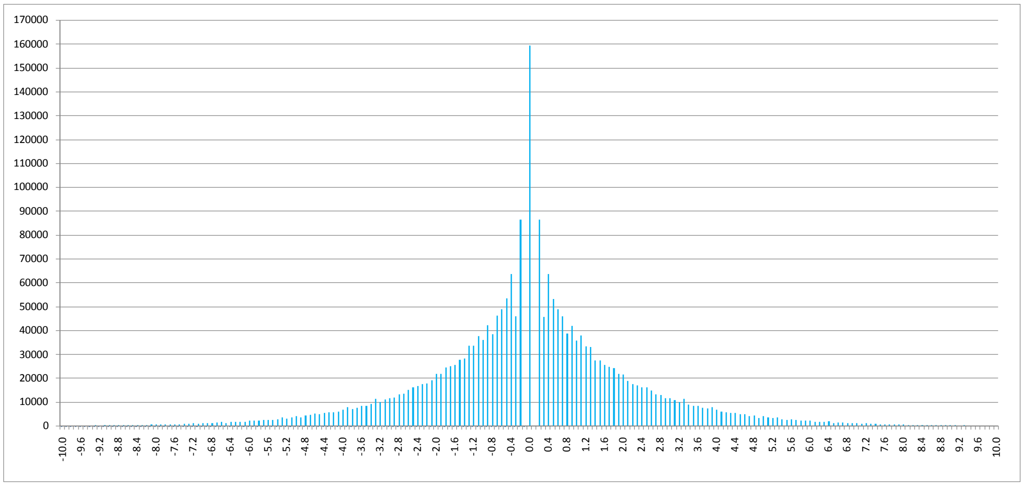
G(1.5) =	79.1%	P(X <= 1.5)
1.000 - G(1.5) =	20.9%	P(X > 1.5)
G(2.5) =	88.1%	P(X <= 2.5)

P(1.5 < X <= 2.5) = 9.0% = (0.881 - 0.791)
P(1.5 < X <= 2.5) / P(X > 1.5) = 43.1% = (0.09 / 0.209)
which is in good agreement with 43.0% from the table above.

Hi-Low True Count Frequency Distribution

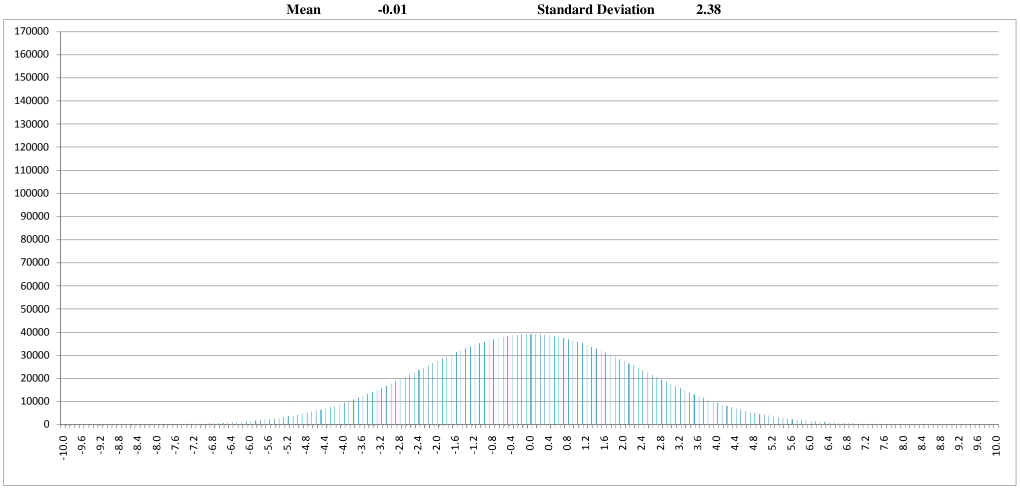
10,000 Six Decks, 4.5 Decks Dealt Simulation

Mean:	-0.01	Skew:	0.01 (unskewed)
Standard Deviation:	2.38	Kurtosis:	5.32 (leptokurtic. Normal Distriubtion has a Kurtosis of 3)
Cards dealt per shoe	234	Total Cards Dealt ≈	2,340,000



Normal Approximation

Mean **-0.01** **Standard Deviation** **2.38**



Sample Hi-Low true count frequencies

Hi-Low true counts shown below in intervals of 0.10. Hi-Low tc = "t" means Hi-Low tc is in the interval (t-0.05, t+0.05)

Hi-Low tc	Hand Freq	Norm App	Difference
-10.0	184	6	178
-9.5	219	14	205
-9.0	341	31	310
-8.5	502	68	434
-8.0	771	140	631
-7.5	610	277	333
-7.0	1,089	525	564
-6.5	1,339	951	388
-6.0	2,248	1,650	598
-5.5	2,483	2,737	(254)
-5.0	4,247	4,347	(100)
-4.5	4,958	6,605	(1,647)
-4.0	6,962	9,603	(2,641)
-3.5	8,459	13,360	(4,901)

Hi-Low tc	Hand Freq	Norm App	Difference
-3.0	11,600	17,785	(6,185)
-2.5	16,201	22,654	(6,453)
-2.0	21,955	27,611	(5,656)
-1.5	27,680	32,201	(4,521)
-1.0	36,028	35,935	93
-0.5	53,447	38,371	15,076
0.0	159,471	39,205	120,266
0.5	53,152	38,330	14,822
1.0	35,753	35,857	(104)
1.5	27,392	32,097	(4,705)
2.0	21,607	27,492	(5,885)
2.5	16,114	22,532	(6,418)
3.0	11,683	17,670	(5,987)
3.5	8,505	13,260	(4,755)

Hi-Low tc	Hand Freq	Norm App	Difference
4.0	6,930	9,521	(2,591)
4.5	4,925	6,541	(1,616)
5.0	4,189	4,301	(112)
5.5	2,571	2,705	(134)
6.0	2,394	1,628	766
6.5	1,342	938	404
7.0	1,124	517	607
7.5	686	273	413
8.0	805	138	667
8.5	439	66	373
9.0	300	31	269
9.5	214	14	200
10.0	193	6	187

Normal Approximation Hi-Low true count interval "t" = { NORMDIST(t+0.05,mean,std dev,TRUE) - NORMDIST(t-0.05,mean,std dev,TRUE) } * {total cards dealt}

The normal approximation underestimates the Hi-Low true count frequencies for Hi-Low true counts less than -6 and greater than + 6 and also underestimates Hi-Low true count frequencies for Hi-Low true counts between -1 and +1. And for Hi-Low true count between +1.5 and +5.5 and between -1.5 and -5.5, the normal approximation overestimates the Hi-Low true count frequency. So there are less Hi-Low true counts of 2, 3, 4 and 5 than would be the case if the Hi-Low true count were normal distributed, but to compensate for this, there are more Hi-Low true counts greater than or equal to 6 than would be the case if the Hi-Low true count distribution were normally distributed.

The Hi-Low true count frequency distribution is leptokurtic. The distribution can be thought of as being constructed from the Normal Distribution by "squeezing" the Normal Distribution between -2 and -5 and between +2 and +5 and the displaced frequencies "popping up" between -1 and +1 and "spread out" at greater than or equal to +6 and less than or equal to -6.

Red 7 Running Count Frequency Distribution

Six Decks, 4.5 decks dealt

15,000 six deck shoes, 234 cards dealt per shoe

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 rc	Hand Freq	f(x)	(X - µ)	(X - µ)^2	(X - µ)^3	(X - µ)^4	F(x)
-35	-	-	(39.4400)	1,555.51	(61,349)	2,419,613	-
-34	-	-	(38.4400)	1,477.63	(56,800)	2,183,392	-
-33	-	-	(37.4400)	1,401.75	(52,481)	1,964,905	-
-32	-	-	(36.4400)	1,327.87	(48,388)	1,763,241	-
-31	-	-	(35.4400)	1,255.99	(44,512)	1,577,513	-
-30	-	-	(34.4400)	1,186.11	(40,850)	1,406,859	-
-29	-	-	(33.4400)	1,118.23	(37,394)	1,250,441	-
-28	4	0.000001	(32.4400)	1,052.35	(34,138)	1,107,443	0.000001
-27	21	0.000006	(31.4400)	988.47	(31,077)	977,075	0.000007
-26	50	0.000014	(30.4400)	926.59	(28,205)	858,571	0.000021
-25	56	0.000016	(29.4400)	866.71	(25,516)	751,189	0.000037
-24	55	0.000016	(28.4400)	808.83	(23,003)	654,208	0.000053
-23	98	0.000028	(27.4400)	752.95	(20,661)	566,936	0.000081
-22	170	0.000048	(26.4400)	699.07	(18,483)	488,701	0.000129
-21	263	0.000075	(25.4400)	647.19	(16,465)	418,857	0.000204
-20	403	0.000115	(24.4400)	597.31	(14,598)	356,781	0.000319
-19	647	0.000184	(23.4400)	549.43	(12,879)	301,875	0.000503
-18	1,099	0.000313	(22.4400)	503.55	(11,300)	253,565	0.000817
-17	1,662	0.000474	(21.4400)	459.67	(9,855)	211,298	0.001290
-16	2,585	0.000736	(20.4400)	417.79	(8,540)	174,550	0.002026
-15	3,981	0.001134	(19.4400)	377.91	(7,347)	142,818	0.003161
-14	5,822	0.001659	(18.4400)	340.03	(6,270)	115,622	0.004819
-13	8,158	0.002324	(17.4400)	304.15	(5,304)	92,509	0.007144
-12	11,576	0.003298	(16.4400)	270.27	(4,443)	73,047	0.010442
-11	16,126	0.004594	(15.4400)	238.39	(3,681)	56,831	0.015036
-10	22,158	0.006313	(14.4400)	208.51	(3,011)	43,477	0.021349
-9	29,728	0.008470	(13.4400)	180.63	(2,428)	32,628	0.029818
-8	39,433	0.011234	(12.4400)	154.75	(1,925)	23,948	0.041053
-7	51,511	0.014675	(11.4400)	130.87	(1,497)	17,128	0.055728
-6	65,286	0.018600	(10.4400)	108.99	(1,138)	11,879	0.074328
-5	81,952	0.023348	(9.4400)	89.11	(841)	7,941	0.097676
-4	102,217	0.029122	(8.4400)	71.23	(601)	5,074	0.126798
-3	125,420	0.035732	(7.4400)	55.35	(412)	3,064	0.162530
-2	150,797	0.042962	(6.4400)	41.47	(267)	1,720	0.205492
-1	177,911	0.050687	(5.4400)	29.59	(161)	876	0.256179
0	193,977	0.055264	(4.4400)	19.71	(88)	389	0.311443
1	203,276	0.057913	(3.4400)	11.83	(41)	140	0.369357
2	197,952	0.056397	(2.4400)	5.95	(15)	35	0.425753
3	193,425	0.055107	(1.4400)	2.07	(3)	4	0.480860
4	186,850	0.053234	(0.4400)	0.19	(0)	0	0.534094
5	178,532	0.050864	0.5600	0.31	0	0	0.584958
6	169,912	0.048408	1.5600	2.43	4	6	0.633366
7	159,493	0.045440	2.5600	6.55	17	43	0.678805
8	148,613	0.042340	3.5600	12.67	45	161	0.721145
9	137,897	0.039287	4.5600	20.79	95	432	0.760432
10	126,666	0.036087	5.5600	30.91	172	956	0.796519

Red 7 Running Count Frequency Distribution

Six Decks, 4.5 decks dealt

15,000 six deck shoes, 234 cards dealt per shoe

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Red 7 rc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
11	113,592	0.032362	6.5600	43.03	282	1,852	0.828881
12	101,179	0.028826	7.5600	57.15	432	3,267	0.857707
13	88,791	0.025297	8.5600	73.27	627	5,369	0.883004
14	76,621	0.021829	9.5600	91.39	874	8,353	0.904833
15	65,237	0.018586	10.5600	111.51	1,178	12,435	0.923419
16	54,934	0.015651	11.5600	133.63	1,545	17,858	0.939070
17	46,065	0.013124	12.5600	157.75	1,981	24,887	0.952194
18	37,489	0.010681	13.5600	183.87	2,493	33,810	0.962875
19	30,116	0.008580	14.5600	211.99	3,087	44,942	0.971455
20	24,166	0.006885	15.5600	242.11	3,767	58,620	0.978340
21	19,020	0.005419	16.5600	274.23	4,541	75,205	0.983758
22	14,678	0.004182	17.5600	308.35	5,415	95,083	0.987940
23	11,597	0.003304	18.5600	344.48	6,393	118,663	0.991244
24	9,000	0.002564	19.5600	382.60	7,484	146,379	0.993808
25	6,728	0.001917	20.5600	422.72	8,691	178,688	0.995725
26	4,835	0.001377	21.5600	464.84	10,022	216,072	0.997103
27	3,429	0.000977	22.5600	508.96	11,482	259,036	0.998079
28	2,467	0.000703	23.5600	555.08	13,078	308,109	0.998782
29	1,631	0.000465	24.5600	603.20	14,815	363,845	0.999247
30	1,031	0.000294	25.5600	653.32	16,699	426,821	0.999541
31	626	0.000178	26.5600	705.44	18,736	497,639	0.999719
32	368	0.000105	27.5600	759.56	20,933	576,925	0.999824
33	201	0.000057	28.5600	815.68	23,296	665,327	0.999881
34	134	0.000038	29.5600	873.80	25,829	763,519	0.999919
35	120	0.000034	30.5600	933.92	28,541	872,199	0.999954
36	73	0.000021	31.5600	996.04	31,435	992,088	0.999974
37	50	0.000014	32.5600	1,060.16	34,519	1,123,931	0.999989
38	30	0.000009	33.5600	1,126.28	37,798	1,268,498	0.999997
39	8	0.000002	34.5600	1,194.40	41,278	1,426,582	0.999999
40	2	0.000001	35.5600	1,264.52	44,966	1,599,002	1.000000
41	-	-	36.5600	1,336.64	48,867	1,786,597	1.000000
42	-	-	37.5600	1,410.76	52,988	1,990,234	1.000000
43	-	-	38.5600	1,486.88	57,334	2,210,802	1.000000
44	-	-	39.5600	1,565.00	61,911	2,449,214	1.000000
45	-	-	40.5600	1,645.12	66,726	2,706,409	1.000000
n/a	3,510,000	1.00000	0.0000	54.4165	111.8071	9267.7658	

Mean(X) = μ = E(X)	4.4400
E(X - μ)^2	54.4165
E(X - μ)^3	111.8071
E(X - μ)^4	9267.7658
Var(X) = E(X - μ)^2	54.4165
SD(X) = SQRT(Var(X))	7.3768
Skew = E(X - μ)^3 / SD^3	0.2785
Kurtosis = E(X - μ)^4 / SD^4	3.1298

Kurtosis ~= 3: mesokurtic

Since Red 7 has an unbalance of 2 per deck:

Expected Mean Red 7 = 2*(Average Decks Played)

= 2*(4,5 decks dealt / 2) = 4.500

Normal Distribution	
Skew = 0	Kurtosis = 3

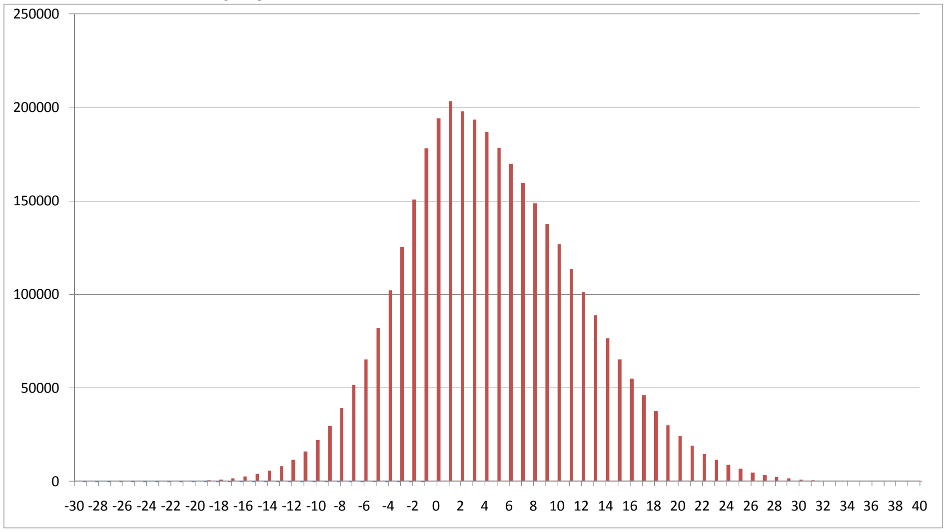
Red 7 Running Count Frequency Distribution

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Mean:	4.44 (expected 4.50) (i)	Skew:	0.28 (skewed to the right) (ii)
Standard Deviation:	7.38	Kurtosis:	3.13 (expected 3.00) (iii)
Cards dealt per shoe	234	Total Cards Dealt ≈	3,510,000

(i) (Red 7 unbalance per deck) * (Average # decks played) = (2)*(4.5/2) = 4.5 (iii) Normal Distribution Kurtosis = 3

(ii) Skew > 0: Distribution has longer right side tail relative to the mean.



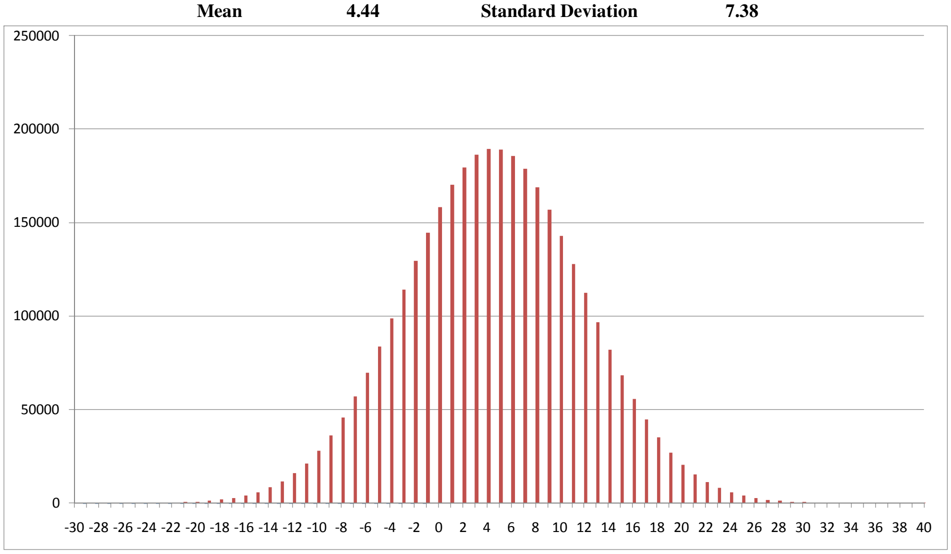
Maximum Value of Red 7 running count was +40 which occurred only twice in 3,150,000 cards dealt. tc = 2 + (rc - 12)/dr
So the absolute maximum true count that could have been obtained would have happened if this Red 7 running count occurred just before the cut card, i.e. dr = 1.5. Then this true count would have been: tc = 2 + (40 - 12)/1.5 ≈ 21
The full Red 7 *true* count CDF recorded true counts from -17.5 to +17.5. Out of 2,340,000 cards dealt, 2,339,988 true counts were recorded so 12 true counts were either > 17.55 or < -17.55.

The Red 7 *running* count CDF shows that F(30) = P(X <= 30) =	0.99954
The chance of the Red 7 running count exceeding +30 is	0.046%
So the maximum practical true count (assuming dr=1.5) would be:	tc = 2 + (30 - 12)/1.5 = 14
The full Red 7 *true* count CDF shows that F(14.0) = P(X < 14.05) =	0.99995
The chance of the Red 7 true count being greater than 14 is actually	0.005%

Since 4.5 out of 6 decks are dealt, the average number of decks dealt is 2.25 decks.
The Red 7 has an unbalance of 2 per deck so the mean Red 7 running count would be 2 * 2.25 = 4.5.
The Red 7 true count at the mean Red 7 running count of 4.5 and the mean decks played (dp) of 2.25 is zero:
tc = 2 + (4.5 - 12) / (6.00 - 2.25) = 2 + (-7.50) / (3.75) = 0.

Normal Approximation

Mean **4.44** **Standard Deviation** **7.38**

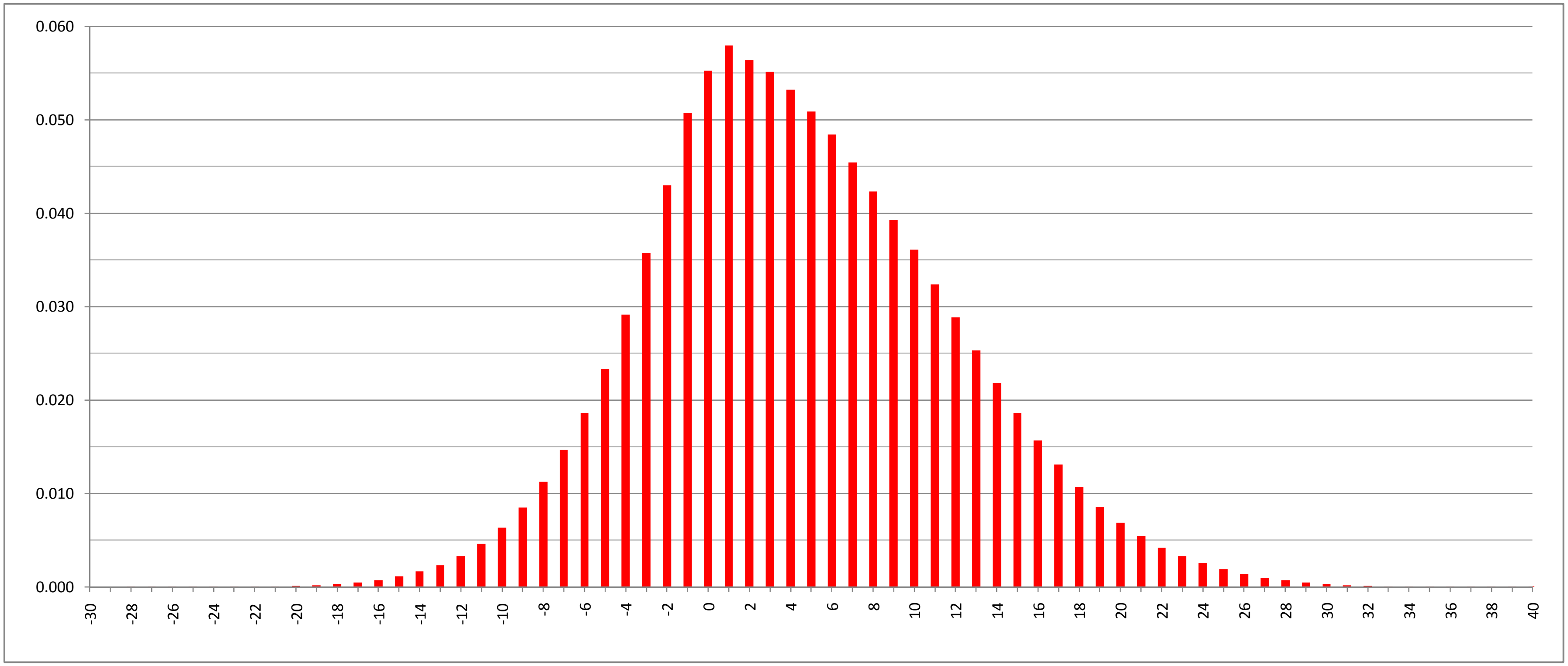


Normal Approximation Balanced Red 7 running count interval "t"
= { NORMDIST(t+0.5,mean,std dev,TRUE) - NORMDIST(t-0.5,mean,std dev,TRUE) } * {total cards dealt}

Red 7 Running Count (PDF) Probability Density Function

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

f(x) = Prob(Red 7 Running Count = x) = Prob(X = x)



X = Red 7 Running Count, Six Decks, 4.5 Decks Dealt. f(x) = P(X = x)

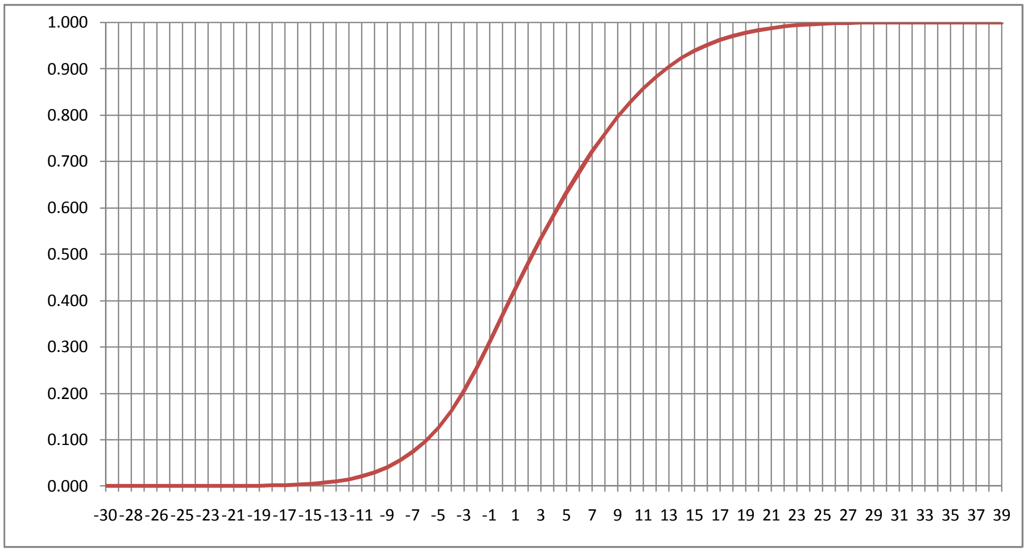
x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)
-30	-	-22	0.00005	-14	0.00166	-6	0.01860	2	0.05640	10	0.03609	18	0.01068	26	0.00138	34	0.00004
-29	-	-21	0.00007	-13	0.00232	-5	0.02335	3	0.05511	11	0.03236	19	0.00858	27	0.00098	35	0.00003
-28	0.00000	-20	0.00011	-12	0.00330	-4	0.02912	4	0.05323	12	0.02883	20	0.00688	28	0.00070	36	0.00002
-27	0.00001	-19	0.00018	-11	0.00459	-3	0.03573	5	0.05086	13	0.02530	21	0.00542	29	0.00046	37	0.00001
-26	0.00001	-18	0.00031	-10	0.00631	-2	0.04296	6	0.04841	14	0.02183	22	0.00418	30	0.00029	38	0.00001
-25	0.00002	-17	0.00047	-9	0.00847	-1	0.05069	7	0.04544	15	0.01859	23	0.00330	31	0.00018	39	0.00000
-24	0.00002	-16	0.00074	-8	0.01123	0	0.05526	8	0.04234	16	0.01565	24	0.00256	32	0.00010	40	0.00000
-23	0.00003	-15	0.00113	-7	0.01468	1	0.05791	9	0.03929	17	0.01312	25	0.00192	33	0.00006		

Red 7 Running Count (CDF) Cumulative Distribution Function

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

F(x) = Prob(Red 7 Running Count <= "x") = Prob(X <= x)

F(x) = Summation { f(k) } from k = -∞ to x



X = Red 7 running count, Six Decks, 4.5 Decks Dealt. F(x) = P(X <= x)

x	F(x)	x	F(x)	x	F(x)	x	F(x)
-30	-	-12	0.01044	6	0.63337	24	0.99381
-29	-	-11	0.01504	7	0.67881	25	0.99573
-28	0.00000	-10	0.02135	8	0.72115	26	0.99710
-27	0.00001	-9	0.02982	9	0.76043	27	0.99808
-26	0.00002	-8	0.04105	10	0.79652	28	0.99878
-25	0.00004	-7	0.05573	11	0.82888	29	0.99925
-24	0.00005	-6	0.07433	12	0.85771	30	0.99954
-23	0.00008	-5	0.09768	13	0.88300	31	0.99972
-22	0.00013	-4	0.12680	14	0.90483	32	0.99982
-21	0.00020	-3	0.16253	15	0.92342	33	0.99988
-20	0.00032	-2	0.20549	16	0.93907	34	0.99992
-19	0.00050	-1	0.25618	17	0.95219	35	0.99995
-18	0.00082	0	0.31144	18	0.96287	36	0.99997
-17	0.00129	1	0.36936	19	0.97145	37	0.99999
-16	0.00203	2	0.42575	20	0.97834	38	1.00000
-15	0.00316	3	0.48086	21	0.98376	39	1.00000
-14	0.00482	4	0.53409	22	0.98794	40	1.00000
-13	0.00714	5	0.58496	23	0.99124		

Examples (Compare with Cumulative Red 7 True Count examples)

Prob(Red 7 True Count >= 2) = Prob(Red 7 Running Count >= 12) = Prob(X >= 12)
= 1.0 - Prob(X <= 11) = 1.0 - F(11) = 1.0 - 0.829 = 17.1%

Prob(15 <= Red 7 Running Count <= 17) = Prob(15 <= X <= 17) = Prob(X <= 17) - Prob(X <= 14)
= F(17) - F(14) = 0.952 - 0.905 = 4.7%

Prob(15 <= X <= 17 given X >= 12) = Prob(15 <= X <= 17) / P(X >= 12)
= 0.047 / 0.171 = 27.7%

So if back counting a six deck shoe, once you know that the Red 7 running count is greater than 12 and so you are playing the shoe, you will have a Red 7 running count of 15, 16 or 17 around ¼th of the time. If you use a simplified betting schedule where you assume that 3 decks have been played (half of the shoe has been dealt) then your betting schedule is 2 units at Red 7 running counts of 15, 16 or 17 since these Red 7 running counts would correspond to Red 7 true counts between 3 and 4 if three decks have been played. So around ¼th of the time that you are actually playing the shoe (Red 7 running count >= 12), you would be betting 2 units.

Balanced Red 7 Running Count (brc) Frequency Distribution

brc = Red 7 - 2*dp (tc = brc / dr)

Six Decks, 4.5 decks dealt

15,000 Six deck shoes, 234 cards dealt per shoe

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Bal Red 7 rc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-40	-	-	(40.0811)	1,606.49	(64,390)	2,580,813	-
-39	-	-	(39.0811)	1,527.33	(59,690)	2,332,733	-
-38	-	-	(38.0811)	1,450.17	(55,224)	2,102,983	-
-37	-	-	(37.0811)	1,375.00	(50,987)	1,890,637	-
-36	-	-	(36.0811)	1,301.84	(46,972)	1,694,794	-
-35	3	0.000001	(35.0811)	1,230.68	(43,174)	1,514,574	0.000001
-34	8	0.000002	(34.0811)	1,161.52	(39,586)	1,349,125	0.000003
-33	11	0.000003	(33.0811)	1,094.36	(36,202)	1,197,615	0.000006
-32	21	0.000006	(32.0811)	1,029.19	(33,018)	1,059,240	0.000012
-31	41	0.000012	(31.0811)	966.03	(30,025)	933,218	0.000024
-30	95	0.000027	(30.0811)	904.87	(27,219)	818,789	0.000051
-29	166	0.000047	(29.0811)	845.71	(24,594)	715,221	0.000098
-28	249	0.000071	(28.0811)	788.55	(22,143)	621,804	0.000169
-27	358	0.000102	(27.0811)	733.38	(19,861)	537,851	0.000271
-26	515	0.000147	(26.0811)	680.22	(17,741)	462,701	0.000418
-25	666	0.000190	(25.0811)	629.06	(15,777)	395,716	0.000608
-24	999	0.000285	(24.0811)	579.90	(13,965)	336,281	0.000892
-23	1,332	0.000379	(23.0811)	532.74	(12,296)	283,807	0.001272
-22	1,921	0.000547	(22.0811)	487.57	(10,766)	237,727	0.001819
-21	2,707	0.000771	(21.0811)	444.41	(9,369)	197,501	0.002590
-20	3,961	0.001128	(20.0811)	403.25	(8,098)	162,610	0.003719
-19	5,563	0.001585	(19.0811)	364.09	(6,947)	132,559	0.005304
-18	7,728	0.002202	(18.0811)	326.92	(5,911)	106,880	0.007505
-17	10,653	0.003035	(17.0811)	291.76	(4,984)	85,125	0.010540
-16	14,416	0.004107	(16.0811)	258.60	(4,159)	66,874	0.014648
-15	19,459	0.005544	(15.0811)	227.44	(3,430)	51,728	0.020191
-14	25,897	0.007378	(14.0811)	198.28	(2,792)	39,313	0.027570
-13	33,319	0.009493	(13.0811)	171.11	(2,238)	29,280	0.037062
-12	41,698	0.011880	(12.0811)	145.95	(1,763)	21,302	0.048942
-11	51,702	0.014730	(11.0811)	122.79	(1,361)	15,077	0.063672
-10	63,439	0.018074	(10.0811)	101.63	(1,025)	10,328	0.081746
-9	76,994	0.021936	(9.0811)	82.47	(749)	6,801	0.103681
-8	92,411	0.026328	(8.0811)	65.30	(528)	4,265	0.130009
-7	108,915	0.031030	(7.0811)	50.14	(355)	2,514	0.161039
-6	126,132	0.035935	(6.0811)	36.98	(225)	1,367	0.196974
-5	145,290	0.041393	(5.0811)	25.82	(131)	667	0.238367
-4	165,292	0.047092	(4.0811)	16.65	(68)	277	0.285459
-3	184,967	0.052697	(3.0811)	9.49	(29)	90	0.338156
-2	205,448	0.058532	(2.0811)	4.33	(9)	19	0.396688
-1	226,753	0.064602	(1.0811)	1.17	(1)	1	0.461290
0	223,606	0.063705	(0.0811)	0.01	(0)	0	0.524996
1	230,572	0.065690	0.9189	0.84	1	1	0.590686
2	211,917	0.060375	1.9189	3.68	7	14	0.651061
3	191,726	0.054623	2.9189	8.52	25	73	0.705684
4	171,312	0.048807	3.9189	15.36	60	236	0.754491
5	150,261	0.042809	4.9189	24.20	119	585	0.797300

Balanced Red 7 Running Count (brc) Frequency Distribution

brc = Red 7 - 2*dp (tc = brc / dr)

Six Decks, 4.5 decks dealt

15,000 Six deck shoes, 234 cards dealt per shoe

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Bal Red 7 rc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
6	130,743	0.037249	5.9189	35.03	207	1,227	0.834549
7	112,170	0.031957	6.9189	47.87	331	2,292	0.866506
8	94,467	0.026914	7.9189	62.71	497	3,933	0.893420
9	78,891	0.022476	8.9189	79.55	709	6,328	0.915896
10	65,096	0.018546	9.9189	98.39	976	9,680	0.934442
11	52,817	0.015048	10.9189	119.22	1,302	14,214	0.949489
12	42,215	0.012027	11.9189	142.06	1,693	20,181	0.961516
13	33,451	0.009530	12.9189	166.90	2,156	27,855	0.971046
14	26,193	0.007462	13.9189	193.74	2,697	37,534	0.978509
15	20,192	0.005753	14.9189	222.57	3,321	49,540	0.984262
16	15,439	0.004399	15.9189	253.41	4,034	64,218	0.988660
17	11,415	0.003252	16.9189	286.25	4,843	81,939	0.991912
18	8,403	0.002394	17.9189	321.09	5,754	103,098	0.994306
19	6,366	0.001814	18.9189	357.93	6,772	128,111	0.996120
20	4,672	0.001331	19.9189	396.76	7,903	157,422	0.997451
21	3,203	0.000913	20.9189	437.60	9,154	191,496	0.998364
22	2,088	0.000595	21.9189	480.44	10,531	230,823	0.998958
23	1,385	0.000395	22.9189	525.28	12,039	275,917	0.999353
24	953	0.000272	23.9189	572.12	13,684	327,317	0.999625
25	591	0.000168	24.9189	620.95	15,474	385,584	0.999793
26	329	0.000094	25.9189	671.79	17,412	451,304	0.999887
27	188	0.000054	26.9189	724.63	19,506	525,088	0.999940
28	90	0.000026	27.9189	779.47	21,762	607,570	0.999966
29	48	0.000014	28.9189	836.31	24,185	699,407	0.999979
30	33	0.000009	29.9189	895.14	26,782	801,282	0.999989
31	25	0.000007	30.9189	955.98	29,558	913,900	0.999996
32	11	0.000003	31.9189	1,018.82	32,520	1,037,992	0.999999
33	2	0.000001	32.9189	1,083.66	35,673	1,174,313	1.000000
34	1	0.000000	33.9189	1,150.49	39,024	1,323,639	1.000000
35	-	-	34.9189	1,219.33	42,578	1,486,773	1.000000
36	-	-	35.9189	1,290.17	46,342	1,664,540	1.000000
37	-	-	36.9189	1,363.01	50,321	1,857,792	1.000000
38	-	-	37.9189	1,437.85	54,522	2,067,403	1.000000
39	-	-	38.9189	1,514.68	58,950	2,294,269	1.000000
40	-	-	39.9189	1,593.52	63,612	2,539,313	1.000000
n/a	3,510,000	1.00000	0.0000	47.7178	-4.3417	7724.2341	

Mean(X) = μ = E(X) 0.0811

E(X - μ)^2 47.7178

E(X - μ)^3 -4.3417

E(X - μ)^4 7724.2341

Normal Distribution	
Skew = 0	Kurtosis = 3

Var(X) = E(X - μ)^2 47.7178

SD(X) = SQRT(Var(X)) 6.9078

Skew = E(X - μ)^3 / SD^3 (0.0132)

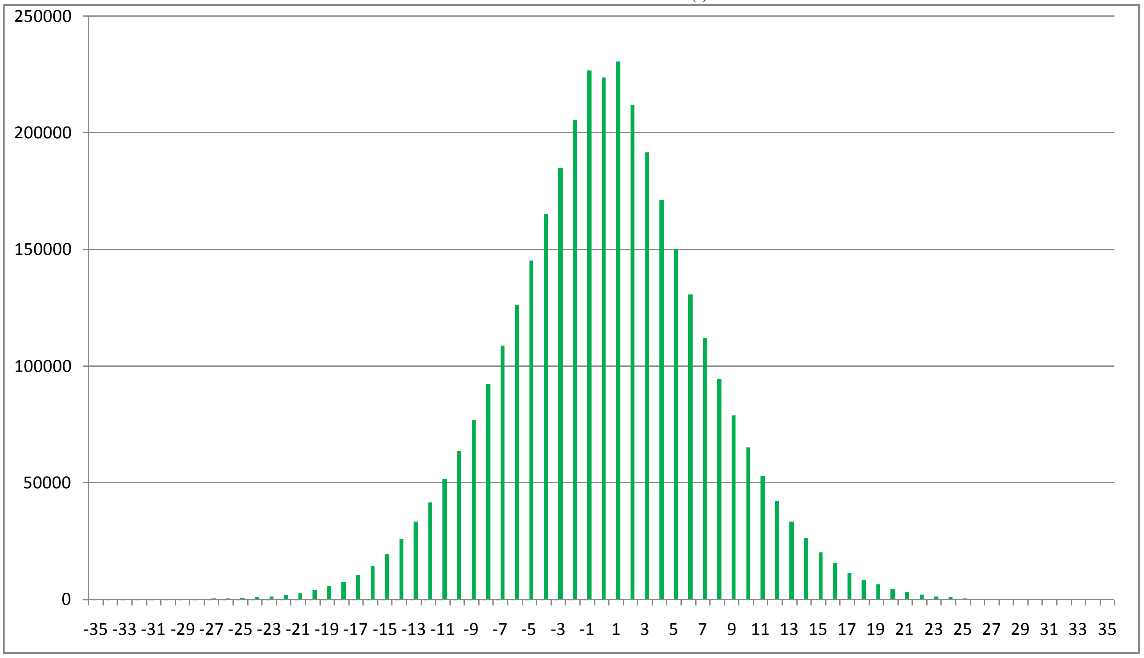
Kurtosis = E(X - μ)^4 / SD^4 3.3923 Kurtosis ~= 3: mesokurtic

Balanced Red 7 Running Count (brc) Frequency Distribution
brc = Red 7 - 2*dp (tc = brc / dr)

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation

Mean:	0.08 (expected 0)	Skew:	-0.01 (expected 0)
Standard Deviation:	6.91	Kurtosis:	3.39 (expected 3.00) (i)
Cards dealt per shoe	234	Total Cards Dealt ≈	3,510,000

(i) Normal Distribution Kurtosis = 3

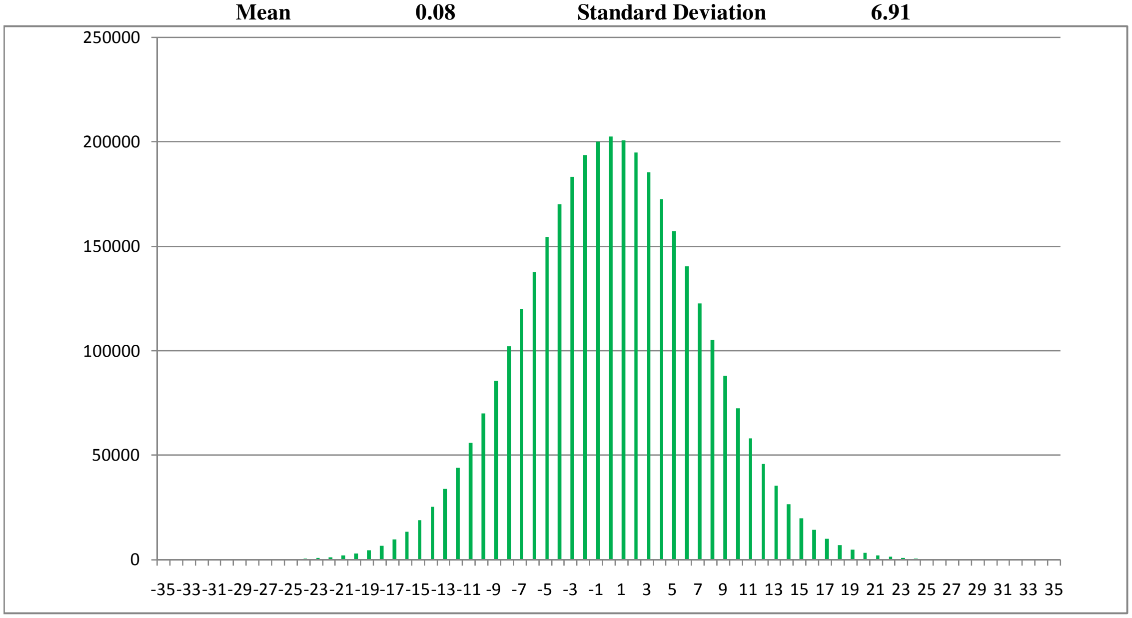


brc = balanced Red 7 running count = Red 7 - 2*dp where dp = decks played. If n = number decks & dr = decks remaining
brc = Red 7 - 2*dp = Red 7 - 2*(n - dr) = Red 7 - 2*n + 2*dr. Since tc = brc / dr then tc = 2 + (Red 7 - 2*n)/dr.

Unlike the Red 7 true count distribution, the normal distribution gives a good approximation to the Balanced Red 7 running count. However the Balanced Red 7 Running Count distribution is still somewhat leptokurtic.

Normal Approximation

Mean **0.08** **Standard Deviation** **6.91**



Normal Approximation Balanced Red 7 running count interval "t"
= { NORMDIST(t+0.5,mean,std dev,TRUE) - NORMDIST(t-0.5,mean,std dev,TRUE) } * {total cards dealt}

Hi-Low Running Count Frequency Distribution

Six Decks, 4.5 decks dealt

15,000 Six deck shoes, 234 cards dealt per shoe

f(x) = probability density function   F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low rc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
-40	-	-	(40.0493)	1,603.95	(64,237)	2,572,648	-
-39	-	-	(39.0493)	1,524.85	(59,544)	2,325,164	-
-38	-	-	(38.0493)	1,447.75	(55,086)	2,095,981	-
-37	-	-	(37.0493)	1,372.65	(50,856)	1,884,172	-
-36	-	-	(36.0493)	1,299.55	(46,848)	1,688,838	-
-35	-	-	(35.0493)	1,228.45	(43,056)	1,509,100	-
-34	2	0.000001	(34.0493)	1,159.36	(39,475)	1,344,106	0.000001
-33	9	0.000003	(33.0493)	1,092.26	(36,098)	1,193,026	0.000003
-32	18	0.000005	(32.0493)	1,027.16	(32,920)	1,055,055	0.000008
-31	23	0.000007	(31.0493)	964.06	(29,933)	929,411	0.000015
-30	46	0.000013	(30.0493)	902.96	(27,133)	815,339	0.000028
-29	59	0.000017	(29.0493)	843.86	(24,514)	712,104	0.000045
-28	85	0.000024	(28.0493)	786.76	(22,068)	618,998	0.000069
-27	149	0.000042	(27.0493)	731.67	(19,791)	535,334	0.000111
-26	261	0.000074	(26.0493)	678.57	(17,676)	460,453	0.000186
-25	401	0.000114	(25.0493)	627.47	(15,718)	393,716	0.000300
-24	599	0.000171	(24.0493)	578.37	(13,909)	334,511	0.000471
-23	941	0.000268	(23.0493)	531.27	(12,245)	282,249	0.000739
-22	1,465	0.000417	(22.0493)	486.17	(10,720)	236,363	0.001156
-21	2,272	0.000647	(21.0493)	443.07	(9,326)	196,314	0.001803
-20	3,429	0.000977	(20.0493)	401.97	(8,059)	161,584	0.002780
-19	4,937	0.001407	(19.0493)	362.88	(6,913)	131,679	0.004187
-18	6,971	0.001986	(18.0493)	325.78	(5,880)	106,131	0.006173
-17	9,402	0.002679	(17.0493)	290.68	(4,956)	84,494	0.008852
-16	12,854	0.003662	(16.0493)	257.58	(4,134)	66,348	0.012514
-15	17,575	0.005007	(15.0493)	226.48	(3,408)	51,294	0.017521
-14	23,235	0.006620	(14.0493)	197.38	(2,773)	38,960	0.024140
-13	30,174	0.008597	(13.0493)	170.28	(2,222)	28,997	0.032737
-12	39,140	0.011151	(12.0493)	145.19	(1,749)	21,079	0.043888
-11	49,484	0.014098	(11.0493)	122.09	(1,349)	14,905	0.057986
-10	61,276	0.017458	(10.0493)	100.99	(1,015)	10,199	0.075444
-9	74,906	0.021341	(9.0493)	81.89	(741)	6,706	0.096784
-8	91,190	0.025980	(8.0493)	64.79	(522)	4,198	0.122764
-7	108,480	0.030906	(7.0493)	49.69	(350)	2,469	0.153670
-6	127,370	0.036288	(6.0493)	36.59	(221)	1,339	0.189958
-5	147,791	0.042106	(5.0493)	25.50	(129)	650	0.232064
-4	169,774	0.048369	(4.0493)	16.40	(66)	269	0.280432
-3	191,936	0.054683	(3.0493)	9.30	(28)	86	0.335115
-2	212,903	0.060656	(2.0493)	4.20	(9)	18	0.395771
-1	233,534	0.066534	(1.0493)	1.10	(1)	1	0.462305
0	239,235	0.068158	(0.0493)	0.00	(0)	0	0.530463
1	237,070	0.067541	0.9507	0.90	1	1	0.598005
2	215,417	0.061372	1.9507	3.81	7	14	0.659377
3	193,194	0.055041	2.9507	8.71	26	76	0.714418
4	171,255	0.048791	3.9507	15.61	62	244	0.763209
5	149,217	0.042512	4.9507	24.51	121	601	0.805721

Hi-Low Running Count Frequency Distribution

Six Decks, 4.5 decks dealt

15,000 Six deck shoes, 234 cards dealt per shoe

f(x) = probability density function F(x) = cumulative distribution function = Prob(X <= x)

X		f(x)					F(x)
Hi-Low rc	Hand Freq	f(x)	(X - μ)	(X - μ)^2	(X - μ)^3	(X - μ)^4	F(x)
6	129,514	0.036899	5.9507	35.41	211	1,254	0.842619
7	111,097	0.031652	6.9507	48.31	336	2,334	0.874271
8	93,302	0.026582	7.9507	63.21	503	3,996	0.900852
9	77,741	0.022148	8.9507	80.11	717	6,418	0.923001
10	63,090	0.017974	9.9507	99.02	985	9,804	0.940975
11	50,427	0.014367	10.9507	119.92	1,313	14,380	0.955342
12	39,467	0.011244	11.9507	142.82	1,707	20,397	0.966586
13	30,567	0.008709	12.9507	167.72	2,172	28,130	0.975295
14	23,412	0.006670	13.9507	194.62	2,715	37,878	0.981965
15	17,751	0.005057	14.9507	223.52	3,342	49,963	0.987022
16	13,324	0.003796	15.9507	254.42	4,058	64,732	0.990818
17	9,879	0.002815	16.9507	287.33	4,870	82,556	0.993632
18	7,221	0.002057	17.9507	322.23	5,784	103,830	0.995690
19	4,950	0.001410	18.9507	359.13	6,806	128,973	0.997100
20	3,350	0.000954	19.9507	398.03	7,941	158,428	0.998054
21	2,270	0.000647	20.9507	438.93	9,196	192,661	0.998701
22	1,498	0.000427	21.9507	481.83	10,577	232,163	0.999128
23	950	0.000271	22.9507	526.73	12,089	277,449	0.999399
24	679	0.000193	23.9507	573.64	13,739	329,058	0.999592
25	527	0.000150	24.9507	622.54	15,533	387,552	0.999742
26	381	0.000109	25.9507	673.44	17,476	453,519	0.999851
27	250	0.000071	26.9507	726.34	19,575	527,569	0.999922
28	146	0.000042	27.9507	781.24	21,836	610,337	0.999964
29	59	0.000017	28.9507	838.14	24,265	702,482	0.999980
30	26	0.000007	29.9507	897.04	26,867	804,687	0.999988
31	21	0.000006	30.9507	957.95	29,649	917,659	0.999994
32	9	0.000003	31.9507	1,020.85	32,617	1,042,127	0.999996
33	5	0.000001	32.9507	1,085.75	35,776	1,178,848	0.999998
34	4	0.000001	33.9507	1,152.65	39,133	1,328,600	0.999999
35	3	0.000001	34.9507	1,221.55	42,694	1,492,186	1.000000
36	1	0.000000	35.9507	1,292.45	46,465	1,670,432	1.000000
37	-	-	36.9507	1,365.35	50,451	1,864,190	1.000000
38	-	-	37.9507	1,440.25	54,659	2,074,333	1.000000
39	-	-	38.9507	1,517.16	59,094	2,301,762	1.000000
40	-	-	39.9507	1,596.06	63,764	2,547,399	1.000000
n/a	3,510,000	1.00000	0.0000	44.4380	0.1977	6709.1111	

Mean(X) = μ = E(X) 0.0493

E(X - μ)^2 44.4380

E(X - μ)^3 0.1977

E(X - μ)^4 6709.1111

Normal Distribution	
Skew = 0	Kurtosis = 3

Var(X) = E(X - μ)^2 44.4380

SD(X) = SQRT(Var(X)) 6.6662

Skew = E(X - μ)^3 / SD^3 0.0007

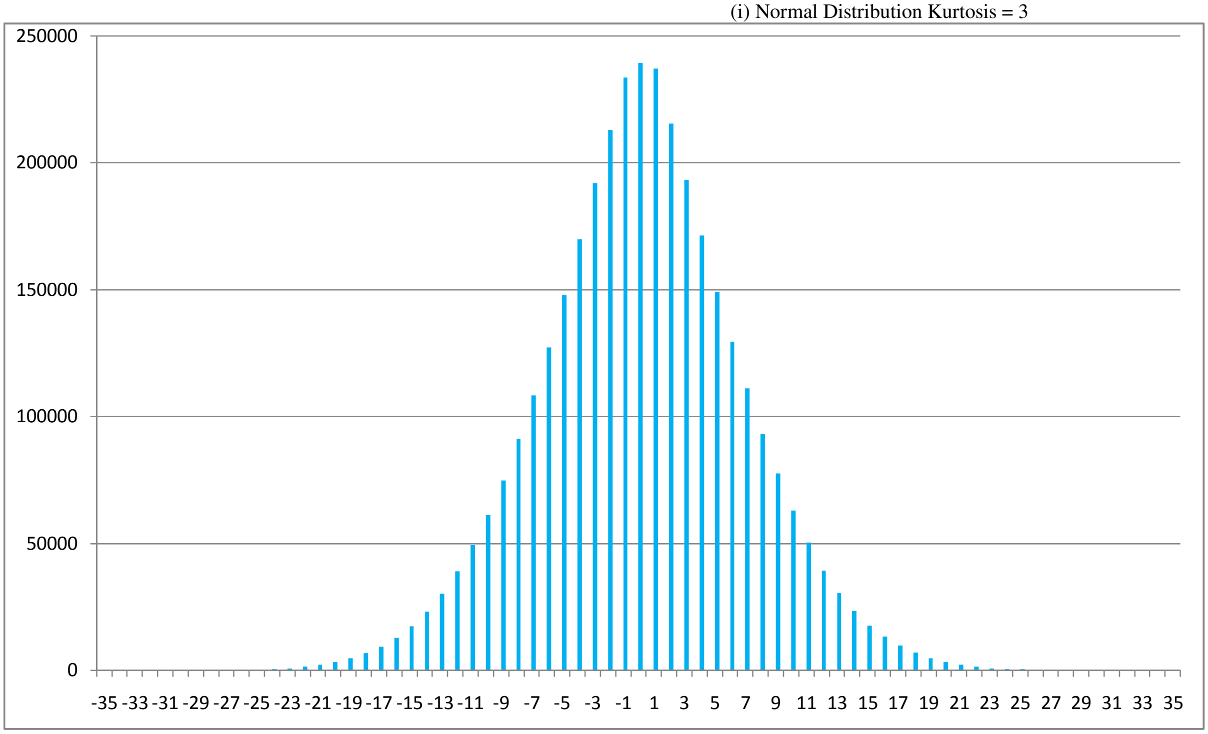
Kurtosis = E(X - μ)^4 / SD^4 3.3975 Kurtosis ~= 3: mesokurtic

Hi-Low Running Count Frequency Distribution

15,000 Six Deck Shoes, 4.5 Decks Dealt Simulation (3,510,000 hands)

Mean:	0.05 (expected 0)	Skew:	0.00 (expected 0)
Standard Deviation:	6.67	Kurtosis:	3.40 (expected 3.00) (i)
Cards dealt per shoe	234	Total Cards Dealt ≈	3,510,000

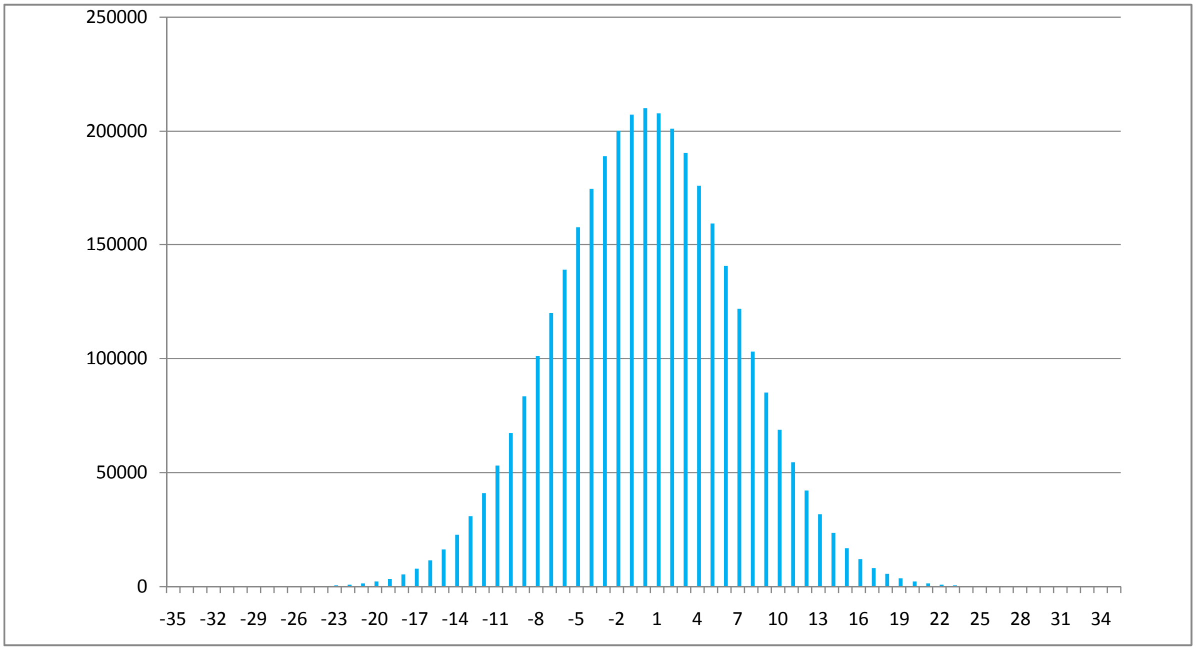
(i) Normal Distribution Kurtosis = 3



Unlike the Hi-Low true count distribution, the normal distribution gives a good approximation to the Hi-Low running count. However the Hi-Low Running Count distribution is still somewhat leptokurtic.

Normal Approximation

Mean **0.05** **Standard Deviation** **6.67**



Normal Approximation Balanced Hi-Low running count interval "t"

= { NORMDIST(t+0.5,mean,std dev,TRUE) - NORMDIST(t-0.5,mean,std dev,TRUE) } * {total cards dealt}

Accuracy of Red 7 True Count for Playing Strategy Variations

Importance of an Accurate True Count
for Playing Strategy Variations

Insurance

Count	Hi-Low
Situation	Insurance
k (# decks) =	6
Cor Coef	76.47%
AACpTCp	2.325%
FDHA,"k" dks	7.692%
MDHA,"k" dks	7.395%
MT, "k" dks	-16.720%
YI, "k" decks	0.000%
Prop Defl Idx	**3.01**

pa = pa(t) = AACpTCp * (t - Idx)

Betting Schedule

Hi-Low True Count	Units Bet
< 2	0
2	1
3	2
4	3
>= 5	4 (max)

Insurance

pa(t) = AACpTCp * (t - Idx)

AACpTCp =	2.325%
Idx =	3.01

Hi-Low True Count >= 2

4.5 out of Six Decks Dealt *

Hi-Low True Count >= 2 True Count	# hands	tc = t tc = (t-1)	% total
2	34,479,737	n/a	43.7%
3	19,630,167	56.9%	24.9%
4	10,847,091	55.3%	13.7%
> =5	13,979,096	n/a	17.7%
Total	78,936,091		100.0%
5	6,202,367	**57.18%**	7.9%
6	3,546,513	57.18%	4.5%
7	2,027,896	57.18%	2.6%
8	1,159,551	57.18%	1.5%
9	663,031	57.18%	0.8%
10	379,121	57.18%	0.5%
Tot 5 to 10	13,978,480	n/a	17.7%
(>=5) - Tot 5 to10	616		0.0%

** BJ Attack, 3rd Edition, Table 6.12*

Flat Betting with tc >= 2

Hi-Low True Count	% total	Units Bet	# units bet in 1,000 Ins decisions	*% Extra Gain by insuring = pa(t)* (A)	(B)	(C)	*% Extra Gain * Units Bet* (A)	(B)	(C)
2	43.7%	1	437	-2.36%	n/a	n/a	(10.30)	n/a	n/a
3	24.9%	1	249	-0.03%	-0.03%	n/a	(0.08)	(0.08)	n/a
4	13.7%	1	137	2.29%	2.29%	2.29%	3.15	3.15	3.15
5	7.9%	1	79	4.62%	4.62%	4.62%	3.63	3.63	3.63
6	4.5%	1	45	6.94%	6.94%	6.94%	3.12	3.12	3.12
7	2.6%	1	26	9.27%	9.27%	9.27%	2.38	2.38	2.38
8	1.5%	1	15	11.59%	11.59%	11.59%	1.70	1.70	1.70
9	0.8%	1	8	13.92%	13.92%	13.92%	1.17	1.17	1.17
10	0.5%	1	5	16.24%	16.24%	16.24%	0.78	0.78	0.78
Total	100.0%	n/a	**1,000**	n/a	n/a	n/a	5.55	15.85	15.93
Average		n/a	n/a	n/a	n/a	n/a	0.555%	1.585%	1.593%
Hand Frequency (BJA, Table 7.1)		n/a	n/a	n/a	n/a	n/a	7.692%	7.692%	7.692%
Total							0.043%	0.122%	0.123%

Accuracy of Red 7 True Count for Playing Strategy Variations

Importance of an Accurate True Count
for Playing Strategy Variations

Insurance

pa(t) = AACpTCp * (t - Idx)

AACpTCp = 2.325% Idx = 3.01

Betting 1 to 4 units with tc >= 2

Hi-Low True Count	% total	Units Bet	# units bet in 1,000 Ins decisions	% Extra Gain by insuring = pa(t) (A)	(B)	(C)	% Extra Gain * Units Bet (A)	(B)	(C)
2	43.7%	1	437	-2.36%	n/a	n/a	(10.30)	n/a	n/a
3	24.9%	2	497	-0.03%	-0.03%	n/a	(0.16)	(0.16)	n/a
4	13.7%	3	412	2.29%	2.29%	2.29%	9.45	9.45	9.45
5	7.9%	4	314	4.62%	4.62%	4.62%	14.51	14.51	14.51
6	4.5%	4	180	6.94%	6.94%	6.94%	12.48	12.48	12.48
7	2.6%	4	103	9.27%	9.27%	9.27%	9.52	9.52	9.52
8	1.5%	4	59	11.59%	11.59%	11.59%	6.81	6.81	6.81
9	0.8%	4	34	13.92%	13.92%	13.92%	4.68	4.68	4.68
10	0.5%	4	19	16.24%	16.24%	16.24%	3.12	3.12	3.12
Total	100.0%	n/a	2,055	n/a	n/a	n/a	50.11	60.41	60.57
Average		n/a	n/a	n/a	n/a	n/a	2.439%	2.940%	2.948%
Hand Frequency (BJA, Table 7.1)		n/a	n/a	n/a	n/a	n/a	7.692%	7.692%	7.692%
Total							0.188%	0.226%	0.227%

(A) The Hi-Low miscalculated true count can come from errors in estimating decks played, division errors, rounding errors, etc. As shown in Exhibit E, the Red 7 calculates true counts 2, 3, 4 and 5 more accurately than the Hi-Low and so is less subject, for true counts 2, 3, 4 and 5, to this type of error in deviating from basic strategy before the true count exceeds the index.

(B) Hi-Low player calculates correct true count and insures at true count 3.

(C) Hi-Low waits to insure until true count is greater than or equal to 4.

Situation (A) when compared to (B) and (C) shows penalty for deviating from basic strategy before the true count exceeds this playing strategy index.
Situations (B) and (C) are virtually identical. So for strategy decisions, if there is some doubt whether index was achieved or not, best to play basic strategy.
Red 7 gives a very accurate true count 3 for insurance. So when Red 7 indicates a true count of 3, insure. This is especially important for insurance since insurance decreases variance and risk.

RED 7 Summary Indices
S17

	Red 7 Indices Rounded					Red 7 Indices				
	Decks					Decks				
Situation	1	2	6	8	Infinite	1	2	6	8	Infinite
Betting, S17, DAS, no LS	0	0	1	1	1	-0.35	0.37	0.82	0.87	1.04
Insurance	1.4	2.4	3.0	3.1	3.4	1.40	2.38	3.04	3.12	3.36
Hard 8 v 5 double	4	4	4	4	4	3.29	3.53	3.69	3.71	3.77
Hard 8 v 6 double	3	3	2	2	2	2.81	2.25	1.88	1.84	1.70
Hard 9 v 2 double	1	1	1	1	1	0.95	0.91	0.89	0.89	0.89
Hard 9 v 7 double	4	4	4	4	4	3.64	3.62	3.61	3.61	3.61
Hard 10 v T double	3	4	4	4	4	2.82	3.16	3.38	3.41	3.49
Hard 10 v A double	3	3	4	4	4	2.25	2.95	3.41	3.46	3.63
Hard 11 v A double	-1	1	1	2	2	-1.42	0.01	0.96	1.08	1.44
Hard 12 v 2	4+	4	3+	3+	3+	4.35	3.72	3.31	3.25	3.10
Hard 12 v 3	3	2	2	2	2	2.63	1.98	1.56	1.50	1.35
Hard 12 v 4	1	0	0	0	0	0.60	0.21	-0.04	-0.07	-0.17
Hard 12 v 5	-1	-1	-2	-2	-2	-1.10	-1.41	-1.61	-1.63	-1.70
Hard 12 v 6	0	-1	-1	-1	-1	-0.16	-0.74	-1.12	-1.16	-1.31
Hard 13 v 2	0	-1	-1	-1	-1	-0.05	-0.52	-0.84	-0.88	-0.99
Hard 13 v 3	-1	-2	-2	-2	-2	-1.41	-1.91	-2.24	-2.28	-2.40
Hard 14 v T	9	9	9	9	9	8.48	8.48	8.48	8.48	8.48
7,7 v T	-1	4	7	8	9	-1.16	4.06	7.08	7.44	8.48
Hard 15 v T	4	4	4	4	4	3.70	3.82	3.91	3.92	3.95
Hard 16 v T	0	0	0	0	0	-0.16	-0.04	0.04	0.05	0.08
Hard 16 v 9	5	5	5	5	5	4.96	5.00	5.03	5.03	5.04
A2 v 4 double	1	3	4	4	4	0.27	2.13	3.36	3.51	3.97
A3 v 4 double	-1	1	2	3	3	-1.49	0.59	1.96	2.13	2.64
A5 v 3 double	5	5	5	5	5	4.23	4.23	4.15	4.14	4.12
A6 v 2 double	0	1	2	2	2	-0.35	0.49	1.04	1.11	1.31
A7 v 2 double	2	1	1	1	1	1.23	0.72	0.39	0.34	0.22
Soft 18 v A, hit/stand	-1	0	1	2	2	-1.79	-0.18	0.89	1.02	1.43
A8 v 6 double	0	1	1	1	1	-0.19	0.33	0.66	0.71	0.83
A8 v 5 double	1	1	2	2	2	0.18	0.87	1.31	1.36	1.52
A8 v 4 double	2	3	4	4	4	1.83	2.60	3.08	3.14	3.32

RED 7 Summary Indices
S17

	Red 7 Indices Rounded					Red 7 Indices				
	Decks					Decks				
Situation	1	2	6	8	Infinite	1	2	6	8	Infinite
A8 v 3 double	4	5	5	5	6	3.44	4.39	5.01	5.08	5.31
A9 v 6 double	5	5	5	5	5	4.35	4.39	4.42	4.43	4.44
A9 v 5 double	5	5	5	5	5	4.45	4.72	4.89	4.91	4.98
TT v 6 Split	6	6	5	5	5	5.72	5.20	4.86	4.82	4.69
T,T v 5 Split	5+	5+	5+	5+	5+	5.15	5.22	5.27	5.27	5.29
Hard 16 v A	7	8	9	9	9	6.84	7.84	8.50	8.58	8.82
Hard 15 v A	9	10	10	10	10	8.29	9.12	9.66	9.73	9.94

Hard 16 v A, S17 and Hard 15 v A, S17 indices calculated so they can be compared with Hard 16 v A, H17 and Hard 15 v A, H17 indices (Exhibit G3).

	Dealer's Up Card										
Player's	S17										**H17**
Hand	2	3	4	5	6	7	8	9	T	A	A
8				4	2						
9	2	d	d	d	d	4					
10	d	d	d	d	d	d	d	d	4	4	3
11	d	d	d	d	d	d	d	d	d	2	double
12	3+	2	0	-2	-1						
13	-1	-2	s	s	s						
15						h	h	h	4	h	6
16						h	h	5	0	h	4
A2			4	d	d						
A3			3	d	d						
A4			d	d	d						
A5		5	d	d	d						
A6	2	d	d	d	d	h	h	h	h	h	"
A7	2	d	d	d	d	s	s	h	h	2	hit
A8		5	4	2	2						
A9				5	5						

h9 v 2 double, h11 v A S17 double, A7 v 2 double, soft 18 v A S17 stand, and A8 v 6 S17 double have indices of +1 but are rounded up to +2 in chart above.

Exhibits G3 and H3 have H17 details.

This Table of True Count Indices is for six and eight deck games.

d = double s = stand h = hit sp = split

Doubling h10 v T: six deck AACpTCp = 0.97% (compared to 2.63% for h10 v A). Risk adjusted doubling index is 5 or 6. (See Exhibit H1)

Exhibit G1 - Red 7 Indices Summary - S17

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Betting, S17, DAS, no LS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	96.83%	Cor Coef	96.83%	Cor Coef	96.83%	Cor Coef	96.83%	Cor Coef	96.83%
AACpTCp	0.495%	AACpTCp	0.495%	AACpTCp	0.495%	AACpTCp	0.495%	AACpTCp	0.495%
FDHA,"k" dks	-0.174%	FDHA,"k" dks	0.182%	FDHA,"k" dks	0.404%	FDHA,"k" dks	0.432%	FDHA, infinite	0.514%
MDHA,"k" dks	-0.174%	MDHA,"k" dks	0.182%	MDHA,"k" dks	0.404%	MDHA,"k" dks	0.432%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	-	YI, "k" decks	-	YI, "k" decks	-	YI, "k" decks	-	YI = 0	n/a
Index, Idx	**-0.35**	Index, Idx	**0.37**	Index, Idx	**0.82**	Index, Idx	**0.87**	Index, Idx	**1.04**

Count **Red 7** Situation ***Insurance***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	80.02%	Cor Coef	78.53%	Cor Coef	77.57%	Cor Coef	77.46%	Cor Coef	77.10%
AACpTCp	2.394%	AACpTCp	2.339%	AACpTCp	2.304%	AACpTCp	2.299%	AACpTCp	2.287%
FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA, infinite	7.692%
MDHA,"k" dks	5.882%	MDHA,"k" dks	6.796%	MDHA,"k" dks	7.395%	MDHA,"k" dks	7.470%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**1.40**	Index, Idx	**2.38**	Index, Idx	**3.04**	Index, Idx	**3.12**	Index, Idx	**3.36**

Count **Red 7** Situation ***Hard 8 v 5 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	90.29%	Cor Coef	90.39%	Cor Coef	90.45%	Cor Coef	90.46%	Cor Coef	90.48%
AACpTCp	1.770%	AACpTCp	1.779%	AACpTCp	1.785%	AACpTCp	1.785%	AACpTCp	1.787%
FDHA,"k" dks	6.593%	FDHA,"k" dks	6.666%	FDHA,"k" dks	6.713%	FDHA,"k" dks	6.718%	FDHA, infinite	6.735%
MDHA,"k" dks	4.083%	MDHA,"k" dks	5.424%	MDHA,"k" dks	6.301%	MDHA,"k" dks	6.410%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**3.29**	Index, Idx	**3.53**	Index, Idx	**3.69**	Index, Idx	**3.71**	Index, Idx	**3.77**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 8 v 6 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	83.95%	Cor Coef	83.49%	Cor Coef	83.20%	Cor Coef	83.16%	Cor Coef	83.05%
AACpTCp	1.679%	AACpTCp	1.660%	AACpTCp	1.648%	AACpTCp	1.647%	AACpTCp	1.642%
FDHA,"k" dks	3.115%	FDHA,"k" dks	2.953%	FDHA,"k" dks	2.847%	FDHA,"k" dks	2.834%	FDHA, infinite	2.794%
MDHA,"k" dks	3.065%	MDHA,"k" dks	2.928%	MDHA,"k" dks	2.839%	MDHA,"k" dks	2.827%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.81**	Index, Idx	**2.25**	Index, Idx	**1.88**	Index, Idx	**1.84**	Index, Idx	**1.70**

Count **Red 7** Situation ***Hard 9 v 2 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	83.62%	Cor Coef	83.76%	Cor Coef	83.85%	Cor Coef	83.86%	Cor Coef	83.89%
AACpTCp	1.506%	AACpTCp	1.506%	AACpTCp	1.506%	AACpTCp	1.506%	AACpTCp	1.506%
FDHA,"k" dks	1.408%	FDHA,"k" dks	1.368%	FDHA,"k" dks	1.344%	FDHA,"k" dks	1.341%	FDHA, infinite	1.333%
MDHA,"k" dks	-0.049%	MDHA,"k" dks	0.646%	MDHA,"k" dks	1.105%	MDHA,"k" dks	1.162%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**0.95**	Index, Idx	**0.91**	Index, Idx	**0.89**	Index, Idx	**0.89**	Index, Idx	**0.89**

Count **Red 7** Situation ***Hard 9 v 7 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	84.67%	Cor Coef	84.53%	Cor Coef	84.44%	Cor Coef	84.43%	Cor Coef	84.40%
AACpTCp	1.891%	AACpTCp	1.883%	AACpTCp	1.878%	AACpTCp	1.877%	AACpTCp	1.876%
FDHA,"k" dks	6.507%	FDHA,"k" dks	6.634%	FDHA,"k" dks	6.719%	FDHA,"k" dks	6.730%	FDHA, infinite	6.762%
MDHA,"k" dks	6.002%	MDHA,"k" dks	6.384%	MDHA,"k" dks	6.636%	MDHA,"k" dks	6.668%	MDHA=FDHA	n/a
MT, "k" dks	0.510	MT, "k" dks	0.252	MT, "k" dks	0.084	MT, "k" dks	0.063	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**3.64**	Index, Idx	**3.62**	Index, Idx	**3.61**	Index, Idx	**3.61**	Index, Idx	**3.61**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 10 v T double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	85.72%	Cor Coef	85.87%	Cor Coef	85.96%	Cor Coef	85.97%	Cor Coef	86.01%
AACpTCp	0.971%	AACpTCp	0.971%	AACpTCp	0.971%	AACpTCp	0.971%	AACpTCp	0.971%
FDHA,"k" dks	2.749%	FDHA,"k" dks	3.073%	FDHA,"k" dks	3.285%	FDHA,"k" dks	3.312%	FDHA, infinite	3.391%
MDHA,"k" dks	3.765%	MDHA,"k" dks	3.576%	MDHA,"k" dks	3.452%	MDHA,"k" dks	3.437%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.82**	Index, Idx	**3.16**	Index, Idx	**3.38**	Index, Idx	**3.41**	Index, Idx	**3.49**

Count **Red 7** Situation ***Hard 10 v A double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	95.40%	Cor Coef	95.38%	Cor Coef	95.37%	Cor Coef	95.37%	Cor Coef	95.36%
AACpTCp	2.647%	AACpTCp	2.637%	AACpTCp	2.631%	AACpTCp	2.630%	AACpTCp	2.628%
FDHA,"k" dks	6.729%	FDHA,"k" dks	8.160%	FDHA,"k" dks	9.091%	FDHA,"k" dks	9.206%	FDHA, infinite	9.549%
MDHA,"k" dks	8.761%	MDHA,"k" dks	9.167%	MDHA,"k" dks	9.424%	MDHA,"k" dks	9.456%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.25**	Index, Idx	**2.95**	Index, Idx	**3.41**	Index, Idx	**3.46**	Index, Idx	**3.63**

Count **Red 7** Situation ***Hard 11 v A double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	86.22%	Cor Coef	84.68%	Cor Coef	83.68%	Cor Coef	83.56%	Cor Coef	83.19%
AACpTCp	2.467%	AACpTCp	2.412%	AACpTCp	2.376%	AACpTCp	2.372%	AACpTCp	2.359%
FDHA,"k" dks	0.852%	FDHA,"k" dks	2.141%	FDHA,"k" dks	2.980%	FDHA,"k" dks	3.084%	FDHA, infinite	3.394%
MDHA,"k" dks	-0.884%	MDHA,"k" dks	1.282%	MDHA,"k" dks	2.696%	MDHA,"k" dks	2.871%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.42**	Index, Idx	**0.01**	Index, Idx	**0.96**	Index, Idx	**1.08**	Index, Idx	**1.44**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 12 v 2***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	67.38%	Cor Coef	67.07%	Cor Coef	66.86%	Cor Coef	66.83%	Cor Coef	66.76%
AACpTCp	1.297%	AACpTCp	1.284%	AACpTCp	1.275%	AACpTCp	1.274%	AACpTCp	1.271%
FDHA,"k" dks	4.490%	FDHA,"k" dks	4.212%	FDHA,"k" dks	4.030%	FDHA,"k" dks	4.007%	FDHA, infinite	3.940%
MDHA,"k" dks	4.373%	MDHA,"k" dks	4.154%	MDHA,"k" dks	4.010%	MDHA,"k" dks	3.993%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**4.35**	Index, Idx	**3.72**	Index, Idx	**3.31**	Index, Idx	**3.25**	Index, Idx	**3.10**

Count **Red 7** Situation ***Hard 12 v 3***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	73.90%	Cor Coef	73.62%	Cor Coef	73.44%	Cor Coef	73.42%	Cor Coef	73.35%
AACpTCp	1.405%	AACpTCp	1.392%	AACpTCp	1.383%	AACpTCp	1.382%	AACpTCp	1.379%
FDHA,"k" dks	2.567%	FDHA,"k" dks	2.206%	FDHA,"k" dks	1.971%	FDHA,"k" dks	1.942%	FDHA, infinite	1.856%
MDHA,"k" dks	2.316%	MDHA,"k" dks	2.081%	MDHA,"k" dks	1.930%	MDHA,"k" dks	1.911%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.63**	Index, Idx	**1.98**	Index, Idx	**1.56**	Index, Idx	**1.50**	Index, Idx	**1.35**

Count **Red 7** Situation ***Hard 12 v 4***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	79.16%	Cor Coef	79.27%	Cor Coef	79.34%	Cor Coef	79.35%	Cor Coef	79.37%
AACpTCp	1.486%	AACpTCp	1.483%	AACpTCp	1.481%	AACpTCp	1.481%	AACpTCp	1.480%
FDHA,"k" dks	0.652%	FDHA,"k" dks	0.196%	FDHA,"k" dks	-0.101%	FDHA,"k" dks	-0.138%	FDHA, infinite	-0.247%
MDHA,"k" dks	-0.561%	MDHA,"k" dks	-0.404%	MDHA,"k" dks	-0.300%	MDHA,"k" dks	-0.287%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**0.60**	Index, Idx	**0.21**	Index, Idx	**-0.04**	Index, Idx	**-0.07**	Index, Idx	**-0.17**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 12 v 5***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	82.57%	Cor Coef	82.65%	Cor Coef	82.70%	Cor Coef	82.71%	Cor Coef	82.73%
AACpTCp	1.538%	AACpTCp	1.535%	AACpTCp	1.532%	AACpTCp	1.532%	AACpTCp	1.531%
FDHA,"k" dks	-1.985%	FDHA,"k" dks	-2.299%	FDHA,"k" dks	-2.506%	FDHA,"k" dks	-2.531%	FDHA, infinite	-2.608%
MDHA,"k" dks	-3.207%	MDHA,"k" dks	-2.904%	MDHA,"k" dks	-2.706%	MDHA,"k" dks	-2.681%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.10**	Index, Idx	**-1.41**	Index, Idx	**-1.61**	Index, Idx	**-1.63**	Index, Idx	**-1.70**

Count **Red 7** Situation ***Hard 12 v 6***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	66.25%	Cor Coef	66.24%	Cor Coef	66.24%	Cor Coef	66.23%	Cor Coef	66.23%
AACpTCp	1.302%	AACpTCp	1.295%	AACpTCp	1.291%	AACpTCp	1.290%	AACpTCp	1.289%
FDHA,"k" dks	-0.778%	FDHA,"k" dks	-1.234%	FDHA,"k" dks	-1.534%	FDHA,"k" dks	-1.571%	FDHA, infinite	-1.683%
MDHA,"k" dks	-1.487%	MDHA,"k" dks	-1.585%	MDHA,"k" dks	-1.650%	MDHA,"k" dks	-1.658%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-0.16**	Index, Idx	**-0.74**	Index, Idx	**-1.12**	Index, Idx	**-1.16**	Index, Idx	**-1.31**

Count **Red 7** Situation ***Hard 13 v 2***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	70.65%	Cor Coef	70.38%	Cor Coef	70.21%	Cor Coef	70.19%	Cor Coef	70.12%
AACpTCp	1.538%	AACpTCp	1.524%	AACpTCp	1.514%	AACpTCp	1.513%	AACpTCp	1.510%
FDHA,"k" dks	-1.325%	FDHA,"k" dks	-1.410%	FDHA,"k" dks	-1.470%	FDHA,"k" dks	-1.478%	FDHA, infinite	-1.501%
MDHA,"k" dks	-1.587%	MDHA,"k" dks	-1.539%	MDHA,"k" dks	-1.513%	MDHA,"k" dks	-1.510%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-0.05**	Index, Idx	**-0.52**	Index, Idx	**-0.84**	Index, Idx	**-0.88**	Index, Idx	**-0.99**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 13 v 3***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	72.28%	Cor Coef	72.06%	Cor Coef	71.92%	Cor Coef	71.90%	Cor Coef	71.85%
AACpTCp	1.650%	AACpTCp	1.636%	AACpTCp	1.626%	AACpTCp	1.625%	AACpTCp	1.622%
FDHA,"k" dks	-3.541%	FDHA,"k" dks	-3.721%	FDHA,"k" dks	-3.838%	FDHA,"k" dks	-3.853%	FDHA, infinite	-3.896%
MDHA,"k" dks	-3.948%	MDHA,"k" dks	-3.922%	MDHA,"k" dks	-3.905%	MDHA,"k" dks	-3.903%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.41**	Index, Idx	**-1.91**	Index, Idx	**-2.24**	Index, Idx	**-2.28**	Index, Idx	**-2.40**

Count **Red 7** Situation ***Hard 14 v T***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	51.70%	Cor Coef	52.17%	Cor Coef	52.47%	Cor Coef	52.51%	Cor Coef	52.62%
AACpTCp	0.831%	AACpTCp	0.836%	AACpTCp	0.839%	AACpTCp	0.839%	AACpTCp	0.841%
FDHA,"k" dks	6.639%	FDHA,"k" dks	6.889%	FDHA,"k" dks	7.051%	FDHA,"k" dks	7.071%	FDHA, infinite	7.131%
MDHA,"k" dks	7.920%	MDHA,"k" dks	7.523%	MDHA,"k" dks	7.261%	MDHA,"k" dks	7.228%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**8.48**	Index, Idx	**8.48**	Index, Idx	**8.48**	Index, Idx	**8.48**	Index, Idx	**8.48**

Count **Red 7** Situation ***7,7 v T***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	56.88%	Cor Coef	54.19%	Cor Coef	53.06%	Cor Coef	52.94%	Cor Coef	52.62%
AACpTCp	0.755%	AACpTCp	0.799%	AACpTCp	0.827%	AACpTCp	0.830%	AACpTCp	0.841%
FDHA,"k" dks	6.639%	FDHA,"k" dks	6.889%	FDHA,"k" dks	7.051%	FDHA,"k" dks	7.071%	FDHA, infinite	7.131%
MDHA,"k" dks	-0.786%	MDHA,"k" dks	3.287%	MDHA,"k" dks	5.874%	MDHA,"k" dks	6.190%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.16**	Index, Idx	**4.06**	Index, Idx	**7.08**	Index, Idx	**7.44**	Index, Idx	**8.48**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 15 v T***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	76.48%	Cor Coef	76.78%	Cor Coef	76.97%	Cor Coef	76.99%	Cor Coef	77.07%
AACpTCp	0.905%	AACpTCp	0.908%	AACpTCp	0.910%	AACpTCp	0.910%	AACpTCp	0.911%
FDHA,"k" dks	3.110%	FDHA,"k" dks	3.355%	FDHA,"k" dks	3.516%	FDHA,"k" dks	3.536%	FDHA, infinite	3.596%
MDHA,"k" dks	4.309%	MDHA,"k" dks	3.949%	MDHA,"k" dks	3.712%	MDHA,"k" dks	3.683%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**3.70**	Index, Idx	**3.82**	Index, Idx	**3.91**	Index, Idx	**3.92**	Index, Idx	**3.95**

Count **Red 7** Situation ***Hard 16 v T***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	56.17%	Cor Coef	56.62%	Cor Coef	56.91%	Cor Coef	56.95%	Cor Coef	57.05%
AACpTCp	0.746%	AACpTCp	0.751%	AACpTCp	0.753%	AACpTCp	0.754%	AACpTCp	0.754%
FDHA,"k" dks	-0.446%	FDHA,"k" dks	-0.192%	FDHA,"k" dks	-0.023%	FDHA,"k" dks	-0.002%	FDHA, infinite	0.061%
MDHA,"k" dks	0.669%	MDHA,"k" dks	0.361%	MDHA,"k" dks	0.160%	MDHA,"k" dks	0.135%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-0.16**	Index, Idx	**-0.04**	Index, Idx	**0.04**	Index, Idx	**0.05**	Index, Idx	**0.08**

Count **Red 7** Situation ***Hard 16 v 9***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	45.44%	Cor Coef	45.43%	Cor Coef	45.43%	Cor Coef	45.42%	Cor Coef	45.42%
AACpTCp	0.670%	AACpTCp	0.671%	AACpTCp	0.671%	AACpTCp	0.671%	AACpTCp	0.671%
FDHA,"k" dks	2.966%	FDHA,"k" dks	3.175%	FDHA,"k" dks	3.313%	FDHA,"k" dks	3.331%	FDHA, infinite	3.382%
MDHA,"k" dks	3.354%	MDHA,"k" dks	3.367%	MDHA,"k" dks	3.377%	MDHA,"k" dks	3.378%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**4.96**	Index, Idx	**5.00**	Index, Idx	**5.03**	Index, Idx	**5.03**	Index, Idx	**5.04**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***A2 v 4 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	66.84%	Cor Coef	65.52%	Cor Coef	64.69%	Cor Coef	64.59%	Cor Coef	64.29%
AACpTCp	1.157%	AACpTCp	1.132%	AACpTCp	1.116%	AACpTCp	1.114%	AACpTCp	1.108%
FDHA,"k" dks	3.985%	FDHA,"k" dks	4.202%	FDHA,"k" dks	4.339%	FDHA,"k" dks	4.355%	FDHA, infinite	4.405%
MDHA,"k" dks	-0.774%	MDHA,"k" dks	1.893%	MDHA,"k" dks	3.584%	MDHA,"k" dks	3.791%	MDHA=FDHA	n/a
MT, "k" dks	1.061	MT, "k" dks	0.515	MT, "k" dks	0.168	MT, "k" dks	0.126	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.27**	Index, Idx	**2.13**	Index, Idx	**3.36**	Index, Idx	**3.51**	Index, Idx	**3.97**

Count **Red 7** Situation ***A3 v 4 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	70.73%	Cor Coef	68.79%	Cor Coef	67.61%	Cor Coef	67.47%	Cor Coef	67.05%
AACpTCp	0.852%	AACpTCp	0.837%	AACpTCp	0.827%	AACpTCp	0.825%	AACpTCp	0.822%
FDHA,"k" dks	2.443%	FDHA,"k" dks	2.302%	FDHA,"k" dks	2.210%	FDHA,"k" dks	2.199%	FDHA, infinite	2.166%
MDHA,"k" dks	-2.067%	MDHA,"k" dks	0.114%	MDHA,"k" dks	1.495%	MDHA,"k" dks	1.664%	MDHA=FDHA	n/a
MT, "k" dks	1.061	MT, "k" dks	0.515	MT, "k" dks	0.168	MT, "k" dks	0.126	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.49**	Index, Idx	**0.59**	Index, Idx	**1.96**	Index, Idx	**2.13**	Index, Idx	**2.64**

low AACpTCp & high Idx => risky double

Count **Red 7** Situation ***A5 v 3 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	39.27%	Cor Coef	36.10%	Cor Coef	34.08%	Cor Coef	33.84%	Cor Coef	33.10%
AACpTCp	0.479%	AACpTCp	0.436%	AACpTCp	0.409%	AACpTCp	0.405%	AACpTCp	0.395%
FDHA,"k" dks	1.869%	FDHA,"k" dks	1.787%	FDHA,"k" dks	1.681%	FDHA,"k" dks	1.668%	FDHA, infinite	1.631%
MDHA,"k" dks	1.575%	MDHA,"k" dks	1.644%	MDHA,"k" dks	1.634%	MDHA,"k" dks	1.633%	MDHA=FDHA	n/a
MT, "k" dks	1.061	MT, "k" dks	0.515	MT, "k" dks	0.168	MT, "k" dks	0.126	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.23**	Index, Idx	**4.23**	Index, Idx	**4.15**	Index, Idx	**4.14**	Index, Idx	**4.12**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***A6 v 2 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	33.71%	Cor Coef	33.15%	Cor Coef	32.79%	Cor Coef	32.74%	Cor Coef	32.61%
AACpTCp	0.524%	AACpTCp	0.511%	AACpTCp	0.503%	AACpTCp	0.502%	AACpTCp	0.499%
FDHA,"k" dks	0.904%	FDHA,"k" dks	0.783%	FDHA,"k" dks	0.699%	FDHA,"k" dks	0.688%	FDHA, infinite	0.655%
MDHA,"k" dks	-0.674%	MDHA,"k" dks	0.018%	MDHA,"k" dks	0.449%	MDHA,"k" dks	0.501%	MDHA=FDHA	n/a
MT, "k" dks	1.061	MT, "k" dks	0.515	MT, "k" dks	0.168	MT, "k" dks	0.126	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-0.35**	Index, Idx	**0.49**	Index, Idx	**1.04**	Index, Idx	**1.11**	Index, Idx	**1.31**

Count **Red 7** Situation ***A7 v 2 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	44.33%	Cor Coef	42.85%	Cor Coef	41.90%	Cor Coef	41.79%	Cor Coef	41.44%
AACpTCp	0.993%	AACpTCp	0.955%	AACpTCp	0.931%	AACpTCp	0.928%	AACpTCp	0.919%
FDHA,"k" dks	0.142%	FDHA,"k" dks	0.174%	FDHA,"k" dks	0.192%	FDHA,"k" dks	0.194%	FDHA, infinite	0.199%
MDHA,"k" dks	0.815%	MDHA,"k" dks	0.501%	MDHA,"k" dks	0.299%	MDHA,"k" dks	0.274%	MDHA=FDHA	n/a
MT, "k" dks	0.531	MT, "k" dks	0.257	MT, "k" dks	0.084	MT, "k" dks	0.063	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**1.23**	Index, Idx	**0.72**	Index, Idx	**0.39**	Index, Idx	**0.34**	Index, Idx	**0.22**

Count **Red 7** Situation ***Soft 18 v A, hit/stand***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	50.31%	Cor Coef	49.42%	Cor Coef	48.85%	Cor Coef	48.77%	Cor Coef	48.56%
AACpTCp	0.534%	AACpTCp	0.522%	AACpTCp	0.514%	AACpTCp	0.513%	AACpTCp	0.510%
FDHA,"k" dks	0.031%	FDHA,"k" dks	0.387%	FDHA,"k" dks	0.615%	FDHA,"k" dks	0.643%	FDHA, infinite	0.727%
MDHA,"k" dks	-0.389%	MDHA,"k" dks	0.180%	MDHA,"k" dks	0.546%	MDHA,"k" dks	0.592%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.79**	Index, Idx	**-0.18**	Index, Idx	**0.89**	Index, Idx	**1.02**	Index, Idx	**1.43**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***A8 v 6 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	81.78%	Cor Coef	81.05%	Cor Coef	80.58%	Cor Coef	80.52%	Cor Coef	80.35%
AACpTCp	2.047%	AACpTCp	2.008%	AACpTCp	1.983%	AACpTCp	1.980%	AACpTCp	1.970%
FDHA,"k" dks	1.772%	FDHA,"k" dks	1.701%	FDHA,"k" dks	1.658%	FDHA,"k" dks	1.653%	FDHA, infinite	1.638%
MDHA,"k" dks	-0.140%	MDHA,"k" dks	0.774%	MDHA,"k" dks	1.355%	MDHA,"k" dks	1.426%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-0.19**	Index, Idx	**0.33**	Index, Idx	**0.66**	Index, Idx	**0.71**	Index, Idx	**0.83**

Count **Red 7** Situation ***A8 v 5 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	85.05%	Cor Coef	85.13%	Cor Coef	85.18%	Cor Coef	85.19%	Cor Coef	85.21%
AACpTCp	2.211%	AACpTCp	2.209%	AACpTCp	2.208%	AACpTCp	2.208%	AACpTCp	2.207%
FDHA,"k" dks	2.810%	FDHA,"k" dks	3.084%	FDHA,"k" dks	3.265%	FDHA,"k" dks	3.287%	FDHA, infinite	3.354%
MDHA,"k" dks	0.668%	MDHA,"k" dks	2.045%	MDHA,"k" dks	2.925%	MDHA,"k" dks	3.033%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.18**	Index, Idx	**0.87**	Index, Idx	**1.31**	Index, Idx	**1.36**	Index, Idx	**1.52**

Count **Red 7** Situation ***A8 v 4 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	76.85%	Cor Coef	77.07%	Cor Coef	77.21%	Cor Coef	77.23%	Cor Coef	77.29%
AACpTCp	2.171%	AACpTCp	2.172%	AACpTCp	2.172%	AACpTCp	2.172%	AACpTCp	2.173%
FDHA,"k" dks	6.735%	FDHA,"k" dks	6.973%	FDHA,"k" dks	7.127%	FDHA,"k" dks	7.146%	FDHA, infinite	7.202%
MDHA,"k" dks	4.245%	MDHA,"k" dks	5.765%	MDHA,"k" dks	6.732%	MDHA,"k" dks	6.851%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**1.83**	Index, Idx	**2.60**	Index, Idx	**3.08**	Index, Idx	**3.14**	Index, Idx	**3.32**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***A8 v 3 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	73.66%	Cor Coef	73.51%	Cor Coef	73.42%	Cor Coef	73.41%	Cor Coef	73.38%
AACpTCp	2.076%	AACpTCp	2.060%	AACpTCp	2.049%	AACpTCp	2.048%	AACpTCp	2.044%
FDHA,"k" dks	10.096%	FDHA,"k" dks	10.477%	FDHA,"k" dks	10.729%	FDHA,"k" dks	10.760%	FDHA, infinite	10.854%
MDHA,"k" dks	7.392%	MDHA,"k" dks	9.165%	MDHA,"k" dks	10.300%	MDHA,"k" dks	10.439%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**3.44**	Index, Idx	**4.39**	Index, Idx	**5.01**	Index, Idx	**5.08**	Index, Idx	**5.31**

Count **Red 7** Situation ***A9 v 6 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	92.00%	Cor Coef	91.26%	Cor Coef	90.79%	Cor Coef	90.73%	Cor Coef	90.56%
AACpTCp	2.988%	AACpTCp	2.940%	AACpTCp	2.909%	AACpTCp	2.905%	AACpTCp	2.893%
FDHA,"k" dks	12.376%	FDHA,"k" dks	12.606%	FDHA,"k" dks	12.760%	FDHA,"k" dks	12.779%	FDHA, infinite	12.837%
MDHA,"k" dks	13.364%	MDHA,"k" dks	13.085%	MDHA,"k" dks	12.916%	MDHA,"k" dks	12.896%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.35**	Index, Idx	**4.39**	Index, Idx	**4.42**	Index, Idx	**4.43**	Index, Idx	**4.44**

Count **Red 7** Situation ***A9 v 5 double***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	95.28%	Cor Coef	95.01%	Cor Coef	94.83%	Cor Coef	94.81%	Cor Coef	94.75%
AACpTCp	3.185%	AACpTCp	3.178%	AACpTCp	3.173%	AACpTCp	3.172%	AACpTCp	3.170%
FDHA,"k" dks	14.721%	FDHA,"k" dks	15.255%	FDHA,"k" dks	15.608%	FDHA,"k" dks	15.652%	FDHA, infinite	15.784%
MDHA,"k" dks	14.549%	MDHA,"k" dks	15.172%	MDHA,"k" dks	15.581%	MDHA,"k" dks	15.632%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.45**	Index, Idx	**4.72**	Index, Idx	**4.89**	Index, Idx	**4.91**	Index, Idx	**4.98**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***TT v 6 Split***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	89.46%	Cor Coef	89.66%	Cor Coef	89.78%	Cor Coef	89.80%	Cor Coef	89.84%
AACpTCp	5.061%	AACpTCp	5.044%	AACpTCp	5.032%	AACpTCp	5.031%	AACpTCp	5.027%
FDHA,"k" dks	25.956%	FDHA,"k" dks	24.736%	FDHA,"k" dks	23.961%	FDHA,"k" dks	23.866%	FDHA, infinite	23.584%
MDHA,"k" dks	34.950%	MDHA,"k" dks	29.100%	MDHA,"k" dks	25.388%	MDHA,"k" dks	24.933%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**5.72**	Index, Idx	**5.20**	Index, Idx	**4.86**	Index, Idx	**4.82**	Index, Idx	**4.69**

Count **Red 7** Situation ***T,T v 5 Split***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	93.50%	Cor Coef	93.71%	Cor Coef	93.83%	Cor Coef	93.85%	Cor Coef	93.90%
AACpTCp	5.443%	AACpTCp	5.462%	AACpTCp	5.474%	AACpTCp	5.475%	AACpTCp	5.480%
FDHA,"k" dks	30.303%	FDHA,"k" dks	29.626%	FDHA,"k" dks	29.203%	FDHA,"k" dks	29.151%	FDHA, infinite	29.000%
MDHA,"k" dks	34.489%	MDHA,"k" dks	31.656%	MDHA,"k" dks	29.866%	MDHA,"k" dks	29.648%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**5.15**	Index, Idx	**5.22**	Index, Idx	**5.27**	Index, Idx	**5.27**	Index, Idx	**5.29**

Count **Red 7** Situation ***Hard 16 v A***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	88.14%	Cor Coef	87.53%	Cor Coef	87.14%	Cor Coef	87.09%	Cor Coef	86.94%
AACpTCp	1.744%	AACpTCp	1.720%	AACpTCp	1.705%	AACpTCp	1.703%	AACpTCp	1.697%
FDHA,"k" dks	13.796%	FDHA,"k" dks	14.392%	FDHA,"k" dks	14.785%	FDHA,"k" dks	14.834%	FDHA, infinite	14.980%
MDHA,"k" dks	13.773%	MDHA,"k" dks	14.381%	MDHA,"k" dks	14.781%	MDHA,"k" dks	14.831%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**6.84**	Index, Idx	**7.84**	Index, Idx	**8.50**	Index, Idx	**8.58**	Index, Idx	**8.82**

Red 7 Indices
S17 (Dealer Stands on soft 17)

Count **Red 7** Situation ***Hard 15 v A***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	79.92%	Cor Coef	79.58%	Cor Coef	79.36%	Cor Coef	79.33%	Cor Coef	79.25%
AACpTCp	1.804%	AACpTCp	1.784%	AACpTCp	1.772%	AACpTCp	1.770%	AACpTCp	1.766%
FDHA,"k" dks	16.485%	FDHA,"k" dks	17.020%	FDHA,"k" dks	17.370%	FDHA,"k" dks	17.413%	FDHA, infinite	17.542%
MDHA,"k" dks	16.858%	MDHA,"k" dks	17.205%	MDHA,"k" dks	17.431%	MDHA,"k" dks	17.459%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**8.29**	Index, Idx	**9.12**	Index, Idx	**9.66**	Index, Idx	**9.73**	Index, Idx	**9.94**

RED 7 Summary Indices
DAS

	Red 7 Indices Rounded* Decks					Red 7 Indices Decks				
Situation	1	2	6	8	Infinite	1	2	6	8	Infinite
Split 2,2 v 8: DAS	11	7	5	5	4	10.37	6.81	4.66	4.40	3.65
Split 4,4 v 4: DAS	2	3	3	3	4	1.37	2.40	3.01	3.09	3.30
Split 7,7 v 8: DAS	-4	0	3	3	4	-4.78	-0.09	2.66	2.99	3.95
Split 8,8 v T, DAS	7	7	7	7	7	7.89	7.67	7.51	7.49	7.43
Split 9,9 v 7: DAS	5	4	4	4	4	4.19	3.70	3.37	3.33	3.21
Split 9,9 v A: DAS	0	2	3	3	3	-0.04	1.65	2.35	2.46	2.85
Split 9,9 v A: DAS, H17	-1	1	2	2	2	-1.39	0.43	1.58	1.72	2.14

** Doubles and Splits are rounded up to the next larger integer (except Splitting 8,8 v T, rounded down)*

** Split 8,8 v T, DAS: Do NOT split, i.e. stand, on 8,8 v T if true count >= Index (see Exhibit I1, I2, I3 and I4)

Player's Hand	Dealer's Up Card S17 2	3	4	5	6	7	8	9	T	A	H17 A
	DAS (Double After Split)										
2,2	sp	sp	sp	sp	sp	sp	5				
3,3	sp	sp	sp	sp	sp	sp					
4,4			3	sp	sp						
6,6	sp	sp	sp	sp	sp						
7,7	sp	sp	sp	sp	sp	sp	3				
8,8	sp	sp	sp	sp	sp	sp	sp	sp	7 *	sp	"
9,9	sp	sp	sp	sp	sp	4	sp	sp	std	3	2
T,T				5+	5						
A,A	sp	sp	sp	sp	sp	sp	sp	sp	sp	sp	"

This Table of True Count Indices is for six and eight deck games. * 8,8 v T DAS: split if Red 7 true count below index, i.e. split if tc <= 7, otherwise stand.

Red 7 Indices
DAS (Double After Split)

low AACpTCp & high Idx => risky split

Count **Red 7** Situation ***Split 2,2 v 8: DAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	19.79%	Cor Coef	20.36%	Cor Coef	20.75%	Cor Coef	20.80%	Cor Coef	20.94%
AACpTCp	0.435%	AACpTCp	0.455%	AACpTCp	0.469%	AACpTCp	0.471%	AACpTCp	0.476%
FDHA,"k" dks	1.613%	FDHA,"k" dks	1.675%	FDHA,"k" dks	1.716%	FDHA,"k" dks	1.721%	FDHA, infinite	1.736%
MDHA,"k" dks	3.642%	MDHA,"k" dks	2.659%	MDHA,"k" dks	2.038%	MDHA,"k" dks	1.962%	MDHA=FDHA	n/a
MT, "k" dks	2.122	MT, "k" dks	1.030	MT, "k" dks	0.337	MT, "k" dks	0.252	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**10.37**	Index, Idx	**6.81**	Index, Idx	**4.66**	Index, Idx	**4.40**	Index, Idx	**3.65**

Count **Red 7** Situation ***Split 4,4 v 4: DAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	77.88%	Cor Coef	78.78%	Cor Coef	79.31%	Cor Coef	79.37%	Cor Coef	79.56%
AACpTCp	1.745%	AACpTCp	1.773%	AACpTCp	1.789%	AACpTCp	1.791%	AACpTCp	1.797%
FDHA,"k" dks	4.656%	FDHA,"k" dks	5.305%	FDHA,"k" dks	5.726%	FDHA,"k" dks	5.778%	FDHA, infinite	5.933%
MDHA,"k" dks	-2.947%	MDHA,"k" dks	1.616%	MDHA,"k" dks	4.520%	MDHA,"k" dks	4.876%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**1.37**	Index, Idx	**2.40**	Index, Idx	**3.01**	Index, Idx	**3.09**	Index, Idx	**3.30**

Count **Red 7** Situation ***Split 7,7 v 8: DAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	28.74%	Cor Coef	29.21%	Cor Coef	29.50%	Cor Coef	29.54%	Cor Coef	29.65%
AACpTCp	0.459%	AACpTCp	0.484%	AACpTCp	0.501%	AACpTCp	0.503%	AACpTCp	0.508%
FDHA,"k" dks	0.299%	FDHA,"k" dks	1.155%	FDHA,"k" dks	1.723%	FDHA,"k" dks	1.794%	FDHA, infinite	2.006%
MDHA,"k" dks	-2.626%	MDHA,"k" dks	-0.265%	MDHA,"k" dks	1.259%	MDHA,"k" dks	1.447%	MDHA=FDHA	n/a
MT, "k" dks	1.061	MT, "k" dks	0.515	MT, "k" dks	0.168	MT, "k" dks	0.126	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-4.78**	Index, Idx	**-0.09**	Index, Idx	**2.66**	Index, Idx	**2.99**	Index, Idx	**3.95**

Red 7 Indices
DAS (Double After Split)

Negative Correlation Coefficient and AACpTCp Count **Red 7** *Stand if (tc) >= Idx* Situation ***Split 8,8 v T, DAS*** *(See Exhibit I1 for details)*

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-46.93%	Cor Coef	-47.44%	Cor Coef	-47.78%	Cor Coef	-47.82%	Cor Coef	-47.94%
AACpTCp	-0.789%	AACpTCp	-0.796%	AACpTCp	-0.801%	AACpTCp	-0.802%	AACpTCp	-0.804%
FDHA,"k" dks	-6.514%	FDHA,"k" dks	-6.256%	FDHA,"k" dks	-6.068%	FDHA,"k" dks	-6.043%	FDHA, infinite	-5.969%
MDHA,"k" dks	-7.155%	MDHA,"k" dks	-6.567%	MDHA,"k" dks	-6.170%	MDHA,"k" dks	-6.120%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**7.89**	Index, Idx	**7.67**	Index, Idx	**7.51**	Index, Idx	**7.49**	Index, Idx	**7.43**

Count **Red 7** Situation ***Split 9,9 v 7: DAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	66.75%	Cor Coef	66.57%	Cor Coef	66.45%	Cor Coef	66.44%	Cor Coef	66.40%
AACpTCp	1.076%	AACpTCp	1.079%	AACpTCp	1.082%	AACpTCp	1.082%	AACpTCp	1.083%
FDHA,"k" dks	4.011%	FDHA,"k" dks	3.747%	FDHA,"k" dks	3.565%	FDHA,"k" dks	3.542%	FDHA, infinite	3.472%
MDHA,"k" dks	4.073%	MDHA,"k" dks	3.777%	MDHA,"k" dks	3.575%	MDHA,"k" dks	3.549%	MDHA=FDHA	n/a
MT, "k" dks	0.531	MT, "k" dks	0.257	MT, "k" dks	0.084	MT, "k" dks	0.063	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.19**	Index, Idx	**3.70**	Index, Idx	**3.37**	Index, Idx	**3.33**	Index, Idx	**3.21**

Red 7 Indices
DAS (Double After Split)

Count **Red 7** Situation ***Split 9,9 v A: DAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	81.31%	Cor Coef	79.74%	Cor Coef	78.82%	Cor Coef	78.71%	Cor Coef	78.40%
AACpTCp	1.291%	AACpTCp	1.302%	AACpTCp	1.309%	AACpTCp	1.310%	AACpTCp	1.313%
FDHA,"k" dks	3.274%	FDHA,"k" dks	3.765%	FDHA,"k" dks	3.613%	FDHA,"k" dks	3.625%	FDHA, infinite	3.745%
MDHA,"k" dks	1.477%	MDHA,"k" dks	2.893%	MDHA,"k" dks	3.328%	MDHA,"k" dks	3.411%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-0.04**	Index, Idx	**1.65**	Index, Idx	**2.35**	Index, Idx	**2.46**	Index, Idx	**2.85**

Count **Red 7** Situation ***Split 9,9 v A: DAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	76.35%	Cor Coef	74.63%	Cor Coef	73.64%	Cor Coef	73.53%	Cor Coef	73.19%
AACpTCp	1.213%	AACpTCp	1.227%	AACpTCp	1.237%	AACpTCp	1.238%	AACpTCp	1.242%
FDHA,"k" dks	1.792%	FDHA,"k" dks	2.219%	FDHA,"k" dks	2.513%	FDHA,"k" dks	2.551%	FDHA, infinite	2.664%
MDHA,"k" dks	-0.247%	MDHA,"k" dks	1.229%	MDHA,"k" dks	2.190%	MDHA,"k" dks	2.309%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.39**	Index, Idx	**0.43**	Index, Idx	**1.58**	Index, Idx	**1.72**	Index, Idx	**2.14**

RED 7 Summary Indices
H17

	Red 7 Indices Rounded					Red 7 Indices				
	Decks					Decks				
Situation	1	2	6	8	Infinite	1	2	6	8	Infinite
Betting, H17, DAS, no LS	0	1	2	2	2	0.04	0.75	1.20	1.26	1.42
h8 v 6: H17	3	3	2	2	2	2.82	2.28	1.92	1.88	1.74
h10 v A: H17	2	3	3	3	3	1.45	2.13	2.58	2.63	2.79
h11 v A: H17	-2	-1	0	0	0	-2.82	-1.43	-0.50	-0.38	-0.03
Hard 12 v 6, H17	-2	-3	-3	-3	-3	-2.64	-3.22	-3.60	-3.65	-3.79
Hard 15 v A, H17	4	5	6	6	6	3.97	4.81	5.36	5.42	5.63
Hard 16 v A, H17	2	3	4	4	4	1.90	2.83	3.45	3.53	3.76
Soft 18 v A, H17, hit/stand	6	8	9	9	9	5.70	7.34	8.43	8.56	8.98
A8 v 6: H17	-1	0	0	0	0	-1.13	-0.77	-0.53	-0.50	-0.41
A9 v 6: H17	4	4	4	4	4	4.00	3.97	3.96	3.96	3.95
Split 9,9 v A: DAS, H17	-1	1	2	2	2	-1.39	0.43	1.58	1.72	2.14
Split 9,9 v A, NDAS, H17	0	2	3	3	4	-0.52	1.39	2.58	2.72	3.15
TT v 6 Split, H17	5	5	5	5	5	5.13	4.63	4.31	4.27	4.15
Hard 15 v A, Late Surrender, H17	-1	-1	0	0	0	-1.97	-1.37	-0.98	-0.94	-0.79
Hard 14 v A, Late Surrender, H17	3	3	4	4	4	2.31	3.02	3.47	3.53	3.70
Split 3,3 v 3, NDAS, H17	4	5	5	5	5	4.02	4.50	4.74	4.77	4.86
Split 6,6 v 2, NDAS, H17	1	1	2	2	2	0.30	0.91	1.26	1.30	1.42

Double hard 11 v A, Double A8 v 6, Late Surrender hard 15 v A are basic strategy under H17.

RED 7 Summary Indices
H17

Comparison of H17 and S17 Red 7 Indices for Selected Situations

	S17: Dealer Stands on soft 17					H17: Dealer Hits soft 17				
Situation	1	2	6	8	Infinite	1	2	6	8	Infinite
Betting, DAS, no LS	-0.35	0.37	0.82	0.87	1.04	0.04	0.75	1.20	1.26	1.42
h8 v 6: H17	2.81	2.25	1.88	1.84	1.70	2.82	2.28	1.92	1.88	1.74
h10 v A	2.25	2.95	3.41	3.46	3.63	1.45	2.13	2.58	2.63	2.79
h11 v A	-1.42	0.01	0.96	1.08	1.44	-2.82	-1.43	-0.50	-0.38	-0.03
Hard 12 v 6	-0.16	-0.74	-1.12	-1.16	-1.31	-2.64	-3.22	-3.60	-3.65	-3.79
Hard 15 v A	8.29	9.12	9.66	9.73	9.94	3.97	4.81	5.36	5.42	5.63
Hard 16 v A	6.84	7.84	8.50	8.58	8.82	1.90	2.83	3.45	3.53	3.76
Soft 18 v A, hit/stand	-1.79	-0.18	0.89	1.02	1.43	5.70	7.34	8.43	8.56	8.98
A8 v 6	-0.19	0.33	0.66	0.71	0.83	-1.13	-0.77	-0.53	-0.50	-0.41
A9 v 6	4.35	4.39	4.42	4.43	4.44	4.00	3.97	3.96	3.96	3.95
Split 9,9 v A: DAS	-0.04	1.65	2.35	2.46	2.85	-1.39	0.43	1.58	1.72	2.14
Split 9,9 v A: NDAS	0.80	2.51	3.59	3.72	4.11	-0.52	1.39	2.58	2.72	3.15
TT v 6 Split	5.72	5.20	4.86	4.82	4.69	5.13	4.63	4.31	4.27	4.15
Hard 15 v A, late surrender	0.49	1.23	1.72	1.78	1.96	-1.97	-1.37	-0.98	-0.94	-0.79
Hard 14 v A, late surrender	4.30	5.15	5.72	5.79	6.00	2.31	3.02	3.47	3.53	3.70
Split 3,3 v 3, NDAS, H17	4.06	4.68	4.94	4.98	5.07	4.02	4.50	4.74	4.77	4.86
Split 6,6 v 2, NDAS, H17	0.73	1.31	1.64	1.68	1.79	0.30	0.91	1.26	1.30	1.42

When dealer's up card is an A or 6 (and to a lesser extent when dealer's up card is a 2, 3, 4 or 5) the player will stand, split and double more often with H17 than with S17. That is because with H17 the dealer must risk drawing another card and possibly busting if dealt a soft 17 where with S17 the dealer is pat and will not bust with a soft 17. The exception is soft 18 v A which under S17 if the dealer had a soft 17 then if player stands on soft 18 v A the player automatically wins, but under H17 if the dealer has a soft 17 and player stood on his soft 18, then player would not automatically win as dealer draws again. Thus for soft 18 v A, hit/stand the player hits more under H17 than under S17. A8 v 6 double, h11 v A double and h15 v A, late surrender become basic strategy plays under H17.

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***Betting, H17, DAS, no LS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	96.98%	Cor Coef	96.98%	Cor Coef	96.98%	Cor Coef	96.98%	Cor Coef	96.98%
AACpTCp	0.514%	AACpTCp	0.514%	AACpTCp	0.514%	AACpTCp	0.514%	AACpTCp	0.514%
FDHA,"k" dks	0.019%	FDHA,"k" dks	0.384%	FDHA,"k" dks	0.617%	FDHA,"k" dks	0.645%	FDHA, infinite	0.732%
MDHA,"k" dks	0.019%	MDHA,"k" dks	0.384%	MDHA,"k" dks	0.617%	MDHA,"k" dks	0.645%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	-	YI, "k" decks	-	YI, "k" decks	-	YI, "k" decks	-	YI = 0	n/a
Index, Idx	**0.04**	Index, Idx	**0.75**	Index, Idx	**1.20**	Index, Idx	**1.26**	Index, Idx	**1.42**

Count **Red 7** Situation ***h8 v 6: H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	82.02%	Cor Coef	81.52%	Cor Coef	81.21%	Cor Coef	81.17%	Cor Coef	81.05%
AACpTCp	1.642%	AACpTCp	1.622%	AACpTCp	1.610%	AACpTCp	1.609%	AACpTCp	1.604%
FDHA,"k" dks	2.982%	FDHA,"k" dks	2.890%	FDHA,"k" dks	2.829%	FDHA,"k" dks	2.821%	FDHA, infinite	2.798%
MDHA,"k" dks	3.016%	MDHA,"k" dks	2.907%	MDHA,"k" dks	2.834%	MDHA,"k" dks	2.825%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.82**	Index, Idx	**2.28**	Index, Idx	**1.92**	Index, Idx	**1.88**	Index, Idx	**1.74**

Count **Red 7** Situation ***h10 v A: H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	95.00%	Cor Coef	94.98%	Cor Coef	94.96%	Cor Coef	94.96%	Cor Coef	94.96%
AACpTCp	2.494%	AACpTCp	2.484%	AACpTCp	2.478%	AACpTCp	2.477%	AACpTCp	2.475%
FDHA,"k" dks	4.392%	FDHA,"k" dks	5.674%	FDHA,"k" dks	6.506%	FDHA,"k" dks	6.609%	FDHA, infinite	6.916%
MDHA,"k" dks	6.264%	MDHA,"k" dks	6.601%	MDHA,"k" dks	6.813%	MDHA,"k" dks	6.839%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**1.45**	Index, Idx	**2.13**	Index, Idx	**2.58**	Index, Idx	**2.63**	Index, Idx	**2.79**

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***h11 v A: H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	86.25%	Cor Coef	84.77%	Cor Coef	83.82%	Cor Coef	83.70%	Cor Coef	83.35%
AACpTCp	2.373%	AACpTCp	2.321%	AACpTCp	2.288%	AACpTCp	2.284%	AACpTCp	2.271%
FDHA,"k" dks	-2.614%	FDHA,"k" dks	-1.323%	FDHA,"k" dks	-0.482%	FDHA,"k" dks	-0.378%	FDHA, infinite	-0.067%
MDHA,"k" dks	-4.187%	MDHA,"k" dks	-2.102%	MDHA,"k" dks	-0.740%	MDHA,"k" dks	-0.571%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-2.82**	Index, Idx	**-1.43**	Index, Idx	**-0.50**	Index, Idx	**-0.38**	Index, Idx	**-0.03**

Count **Red 7** Situation ***Hard 12 v 6, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	73.54%	Cor Coef	73.46%	Cor Coef	73.41%	Cor Coef	73.41%	Cor Coef	73.39%
AACpTCp	1.370%	AACpTCp	1.362%	AACpTCp	1.356%	AACpTCp	1.356%	AACpTCp	1.354%
FDHA,"k" dks	-4.334%	FDHA,"k" dks	-4.737%	FDHA,"k" dks	-5.003%	FDHA,"k" dks	-5.036%	FDHA, infinite	-5.135%
MDHA,"k" dks	-4.955%	MDHA,"k" dks	-5.044%	MDHA,"k" dks	-5.105%	MDHA,"k" dks	-5.112%	MDHA=FDHA	n/a
MT, "k" dks	1.020	MT, "k" dks	0.505	MT, "k" dks	0.167	MT, "k" dks	0.125	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-2.64**	Index, Idx	**-3.22**	Index, Idx	**-3.60**	Index, Idx	**-3.65**	Index, Idx	**-3.79**

Count **Red 7** Situation ***Hard 15 v A, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	82.93%	Cor Coef	82.44%	Cor Coef	82.13%	Cor Coef	82.09%	Cor Coef	81.97%
AACpTCp	1.593%	AACpTCp	1.573%	AACpTCp	1.560%	AACpTCp	1.558%	AACpTCp	1.554%
FDHA,"k" dks	7.904%	FDHA,"k" dks	8.330%	FDHA,"k" dks	8.607%	FDHA,"k" dks	8.641%	FDHA, infinite	8.744%
MDHA,"k" dks	8.010%	MDHA,"k" dks	8.382%	MDHA,"k" dks	8.624%	MDHA,"k" dks	8.654%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**3.97**	Index, Idx	**4.81**	Index, Idx	**5.36**	Index, Idx	**5.42**	Index, Idx	**5.63**

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***Hard 16 v A, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	82.99%	Cor Coef	82.35%	Cor Coef	81.94%	Cor Coef	81.89%	Cor Coef	81.74%
AACpTCp	1.550%	AACpTCp	1.527%	AACpTCp	1.513%	AACpTCp	1.511%	AACpTCp	1.506%
FDHA,"k" dks	4.698%	FDHA,"k" dks	5.181%	FDHA,"k" dks	5.499%	FDHA,"k" dks	5.538%	FDHA, infinite	5.656%
MDHA,"k" dks	4.585%	MDHA,"k" dks	5.125%	MDHA,"k" dks	5.480%	MDHA,"k" dks	5.524%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**1.90**	Index, Idx	**2.83**	Index, Idx	**3.45**	Index, Idx	**3.53**	Index, Idx	**3.76**

Count **Red 7** Situation ***Soft 18 v A, H17, hit/stand***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	67.48%	Cor Coef	66.48%	Cor Coef	65.82%	Cor Coef	65.74%	Cor Coef	65.51%
AACpTCp	0.786%	AACpTCp	0.769%	AACpTCp	0.759%	AACpTCp	0.758%	AACpTCp	0.754%
FDHA,"k" dks	5.761%	FDHA,"k" dks	6.271%	FDHA,"k" dks	6.603%	FDHA,"k" dks	6.644%	FDHA, infinite	6.767%
MDHA,"k" dks	5.312%	MDHA,"k" dks	6.049%	MDHA,"k" dks	6.529%	MDHA,"k" dks	6.589%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**5.70**	Index, Idx	**7.34**	Index, Idx	**8.43**	Index, Idx	**8.56**	Index, Idx	**8.98**

Count **Red 7** Situation ***A8 v 6: H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	83.32%	Cor Coef	82.78%	Cor Coef	82.44%	Cor Coef	82.40%	Cor Coef	82.28%
AACpTCp	1.981%	AACpTCp	1.948%	AACpTCp	1.926%	AACpTCp	1.923%	AACpTCp	1.915%
FDHA,"k" dks	-0.772%	FDHA,"k" dks	-0.785%	FDHA,"k" dks	-0.791%	FDHA,"k" dks	-0.792%	FDHA, infinite	-0.794%
MDHA,"k" dks	-2.006%	MDHA,"k" dks	-1.384%	MDHA,"k" dks	-0.987%	MDHA,"k" dks	-0.938%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.13**	Index, Idx	**-0.77**	Index, Idx	**-0.53**	Index, Idx	**-0.50**	Index, Idx	**-0.41**

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***A9 v 6: H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	92.43%	Cor Coef	91.76%	Cor Coef	91.32%	Cor Coef	91.27%	Cor Coef	91.11%
AACpTCp	2.957%	AACpTCp	2.911%	AACpTCp	2.881%	AACpTCp	2.877%	AACpTCp	2.867%
FDHA,"k" dks	10.754%	FDHA,"k" dks	11.042%	FDHA,"k" dks	11.233%	FDHA,"k" dks	11.257%	FDHA, infinite	11.329%
MDHA,"k" dks	12.191%	MDHA,"k" dks	11.739%	MDHA,"k" dks	11.461%	MDHA,"k" dks	11.427%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.00**	Index, Idx	**3.97**	Index, Idx	**3.96**	Index, Idx	**3.96**	Index, Idx	**3.95**

Count **Red 7** Situation ***Split 9,9 v A: DAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	76.35%	Cor Coef	74.63%	Cor Coef	73.64%	Cor Coef	73.53%	Cor Coef	73.19%
AACpTCp	1.213%	AACpTCp	1.227%	AACpTCp	1.237%	AACpTCp	1.238%	AACpTCp	1.242%
FDHA,"k" dks	1.792%	FDHA,"k" dks	2.219%	FDHA,"k" dks	2.513%	FDHA,"k" dks	2.551%	FDHA, infinite	2.664%
MDHA,"k" dks	-0.247%	MDHA,"k" dks	1.229%	MDHA,"k" dks	2.190%	MDHA,"k" dks	2.309%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.39**	Index, Idx	**0.43**	Index, Idx	**1.58**	Index, Idx	**1.72**	Index, Idx	**2.14**

Count **Red 7** Situation ***Split 9,9 v A, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	60.83%	Cor Coef	58.89%	Cor Coef	57.87%	Cor Coef	57.76%	Cor Coef	57.43%
AACpTCp	0.803%	AACpTCp	0.826%	AACpTCp	0.842%	AACpTCp	0.844%	AACpTCp	0.850%
FDHA,"k" dks	2.538%	FDHA,"k" dks	2.592%	FDHA,"k" dks	2.645%	FDHA,"k" dks	2.652%	FDHA, infinite	2.676%
MDHA,"k" dks	0.535%	MDHA,"k" dks	1.620%	MDHA,"k" dks	2.327%	MDHA,"k" dks	2.415%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-0.52**	Index, Idx	**1.39**	Index, Idx	**2.58**	Index, Idx	**2.72**	Index, Idx	**3.15**

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***TT v 6 Split, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	90.20%	Cor Coef	90.34%	Cor Coef	90.42%	Cor Coef	90.44%	Cor Coef	90.47%
AACpTCp	5.064%	AACpTCp	5.041%	AACpTCp	5.026%	AACpTCp	5.024%	AACpTCp	5.019%
FDHA,"k" dks	22.890%	FDHA,"k" dks	21.824%	FDHA,"k" dks	21.144%	FDHA,"k" dks	21.061%	FDHA, infinite	20.812%
MDHA,"k" dks	31.983%	MDHA,"k" dks	26.236%	MDHA,"k" dks	22.586%	MDHA,"k" dks	22.139%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**5.13**	Index, Idx	**4.63**	Index, Idx	**4.31**	Index, Idx	**4.27**	Index, Idx	**4.15**

Count **Red 7** Situation ***Hard 15 v A, Late Surrender, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	61.94%	Cor Coef	61.53%	Cor Coef	61.27%	Cor Coef	61.24%	Cor Coef	61.14%
AACpTCp	0.894%	AACpTCp	0.882%	AACpTCp	0.875%	AACpTCp	0.874%	AACpTCp	0.871%
FDHA,"k" dks	-0.826%	FDHA,"k" dks	-0.754%	FDHA,"k" dks	-0.710%	FDHA,"k" dks	-0.705%	FDHA, infinite	-0.689%
MDHA,"k" dks	-0.814%	MDHA,"k" dks	-0.748%	MDHA,"k" dks	-0.708%	MDHA,"k" dks	-0.703%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.97**	Index, Idx	**-1.37**	Index, Idx	**-0.98**	Index, Idx	**-0.94**	Index, Idx	**-0.79**

Count **Red 7** Situation ***Hard 14 v A, Late Surrender, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	59.22%	Cor Coef	58.83%	Cor Coef	58.58%	Cor Coef	58.55%	Cor Coef	58.46%
AACpTCp	0.861%	AACpTCp	0.850%	AACpTCp	0.842%	AACpTCp	0.841%	AACpTCp	0.839%
FDHA,"k" dks	2.893%	FDHA,"k" dks	3.002%	FDHA,"k" dks	3.071%	FDHA,"k" dks	3.079%	FDHA, infinite	3.104%
MDHA,"k" dks	2.904%	MDHA,"k" dks	3.008%	MDHA,"k" dks	3.073%	MDHA,"k" dks	3.081%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.31**	Index, Idx	**3.02**	Index, Idx	**3.47**	Index, Idx	**3.53**	Index, Idx	**3.70**

Red 7 Indices
H17 (Dealer Hits soft 17)

Count **Red 7** Situation ***Split 3,3 v 3, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	67.31%	Cor Coef	68.36%	Cor Coef	68.99%	Cor Coef	69.07%	Cor Coef	69.29%
AACpTCp	0.705%	AACpTCp	0.713%	AACpTCp	0.718%	AACpTCp	0.718%	AACpTCp	0.720%
FDHA,"k" dks	3.474%	FDHA,"k" dks	3.508%	FDHA,"k" dks	3.501%	FDHA,"k" dks	3.500%	FDHA, infinite	3.499%
MDHA,"k" dks	0.677%	MDHA,"k" dks	2.151%	MDHA,"k" dks	3.057%	MDHA,"k" dks	3.168%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.02**	Index, Idx	**4.50**	Index, Idx	**4.74**	Index, Idx	**4.77**	Index, Idx	**4.86**

Count **Red 7** Situation ***Split 6,6 v 2, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	55.77%	Cor Coef	56.65%	Cor Coef	57.16%	Cor Coef	57.22%	Cor Coef	57.40%
AACpTCp	1.809%	AACpTCp	1.835%	AACpTCp	1.850%	AACpTCp	1.852%	AACpTCp	1.858%
FDHA,"k" dks	2.664%	FDHA,"k" dks	2.651%	FDHA,"k" dks	2.638%	FDHA,"k" dks	2.637%	FDHA, infinite	2.631%
MDHA,"k" dks	-4.989%	MDHA,"k" dks	-1.062%	MDHA,"k" dks	1.425%	MDHA,"k" dks	1.729%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.30**	Index, Idx	**0.91**	Index, Idx	**1.26**	Index, Idx	**1.30**	Index, Idx	**1.42**

RED 7 Summary Indices
NDAS

Situation	Red 7 Indices Rounded* Decks 1	2	6	8	Infinite	Red 7 Indices Decks 1	2	6	8	Infinite
Split 2,2 v 3, NDAS, H17	-2	5	9	10	12	-2.83	4.25	8.80	9.37	11.05
Split 2,2 v 3, NDAS, S17	-4	4	8	9	10	-4.25	3.12	7.64	8.20	9.89
Split 3,3 v 3, NDAS, H17	5	5	5	5	5	4.02	4.50	4.74	4.77	4.86
Split 3,3 v 3, NDAS, S17	5	5	5	5	6	4.06	4.68	4.94	4.98	5.07
Split 6,6 v 2, NDAS, H17	1	1	2	2	2	0.30	0.91	1.26	1.30	1.42
Split 6,6 v 2, NDAS, S17	1	2	2	2	2	0.73	1.31	1.64	1.68	1.79
Split 8,8 v T, NDAS	5	5	5	5	5	5.27	5.19	5.12	5.11	5.09
Split 9,9 v 7, NDAS	8	8	8	8	8	7.65	7.50	7.38	7.36	7.31
Split 9,9 v A, NDAS, H17	0	2	3	3	4	-0.52	1.39	2.58	2.72	3.15
Split 9,9 v A, NDAS, S17	1	3	4	4	5	0.80	2.51	3.59	3.72	4.11

** Doubles and Splits are rounded up to the next larger integer (except Splitting 8,8 v T, rounded down)*

** Split 8,8 v T, NDAS: Do NOT split, i.e. stand, on 8,8 v T if true count >= Index (see Exhibit I1, I2, I3 and I4)

Player's Hand	Dealer's Up Card S17 2	3	4	5	6	7	8	9	T	A	H17 A
	NDAS (No Double After Split)										
2,2	hit	hit	sp	sp	sp	sp					
3,3	hit	5	sp	sp	sp	sp					
6,6	2	sp	sp	sp	sp						
7,7	sp	sp	sp	sp	sp	sp					
8,8	sp	sp	sp	sp	sp	sp	sp	sp	5 *	sp	
9,9	sp	sp	sp	sp	sp	std	sp	sp	std	4	3
T,T				5+	5						
A,A	sp	sp	sp	sp	sp	sp	sp	sp	sp	sp	"

This Table of True Count Indices is for six and eight deck games.

* 8,8 v T NDAS: split if Red 7 true count below index, i.e. split if tc <= 5, otherwise stand.

Red 7 Indices
NDAS (No Double After Split)

Count **Red 7** Situation ***Split 2,2 v 3, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	12.25%	Cor Coef	12.57%	Cor Coef	12.77%	Cor Coef	12.79%	Cor Coef	12.86%
AACpTCp	0.200%	AACpTCp	0.201%	AACpTCp	0.202%	AACpTCp	0.202%	AACpTCp	0.202%
FDHA,"k" dks	-0.451%	FDHA,"k" dks	0.906%	FDHA,"k" dks	1.793%	FDHA,"k" dks	1.903%	FDHA, infinite	2.234%
MDHA,"k" dks	-1.176%	MDHA,"k" dks	0.555%	MDHA,"k" dks	1.678%	MDHA,"k" dks	1.817%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-2.83**	Index, Idx	**4.25**	Index, Idx	**8.80**	Index, Idx	**9.37**	Index, Idx	**11.05**

Count **Red 7** Situation ***Split 2,2 v 3, NDAS, S17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	12.24%	Cor Coef	12.52%	Cor Coef	12.69%	Cor Coef	12.71%	Cor Coef	12.78%
AACpTCp	0.199%	AACpTCp	0.200%	AACpTCp	0.201%	AACpTCp	0.201%	AACpTCp	0.201%
FDHA,"k" dks	-0.781%	FDHA,"k" dks	0.655%	FDHA,"k" dks	1.543%	FDHA,"k" dks	1.653%	FDHA, infinite	1.987%
MDHA,"k" dks	-1.457%	MDHA,"k" dks	0.326%	MDHA,"k" dks	1.435%	MDHA,"k" dks	1.573%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-4.25**	Index, Idx	**3.12**	Index, Idx	**7.64**	Index, Idx	**8.20**	Index, Idx	**9.89**

Count **Red 7** Situation ***Split 3,3 v 3, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	67.31%	Cor Coef	68.36%	Cor Coef	68.99%	Cor Coef	69.07%	Cor Coef	69.29%
AACpTCp	0.705%	AACpTCp	0.713%	AACpTCp	0.718%	AACpTCp	0.718%	AACpTCp	0.720%
FDHA,"k" dks	3.474%	FDHA,"k" dks	3.508%	FDHA,"k" dks	3.501%	FDHA,"k" dks	3.500%	FDHA, infinite	3.499%
MDHA,"k" dks	0.677%	MDHA,"k" dks	2.151%	MDHA,"k" dks	3.057%	MDHA,"k" dks	3.168%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.02**	Index, Idx	**4.50**	Index, Idx	**4.74**	Index, Idx	**4.77**	Index, Idx	**4.86**

Red 7 Indices
NDAS (No Double After Split)

Count **Red 7** Situation ***Split 3,3 v 3, NDAS, S17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	66.61%	Cor Coef	67.71%	Cor Coef	68.37%	Cor Coef	68.45%	Cor Coef	68.68%
AACpTCp	0.690%	AACpTCp	0.699%	AACpTCp	0.704%	AACpTCp	0.704%	AACpTCp	0.706%
FDHA,"k" dks	3.512%	FDHA,"k" dks	3.601%	FDHA,"k" dks	3.586%	FDHA,"k" dks	3.584%	FDHA, infinite	3.582%
MDHA,"k" dks	0.689%	MDHA,"k" dks	2.231%	MDHA,"k" dks	3.138%	MDHA,"k" dks	3.249%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**4.06**	Index, Idx	**4.68**	Index, Idx	**4.94**	Index, Idx	**4.98**	Index, Idx	**5.07**

Count **Red 7** Situation ***Split 6,6 v 2, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	55.77%	Cor Coef	56.65%	Cor Coef	57.16%	Cor Coef	57.22%	Cor Coef	57.40%
AACpTCp	1.809%	AACpTCp	1.835%	AACpTCp	1.850%	AACpTCp	1.852%	AACpTCp	1.858%
FDHA,"k" dks	2.664%	FDHA,"k" dks	2.651%	FDHA,"k" dks	2.638%	FDHA,"k" dks	2.637%	FDHA, infinite	2.631%
MDHA,"k" dks	-4.989%	MDHA,"k" dks	-1.062%	MDHA,"k" dks	1.425%	MDHA,"k" dks	1.729%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.30**	Index, Idx	**0.91**	Index, Idx	**1.26**	Index, Idx	**1.30**	Index, Idx	**1.42**

Count **Red 7** Situation ***Split 6,6 v 2, NDAS, S17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	55.09%	Cor Coef	55.96%	Cor Coef	56.48%	Cor Coef	56.54%	Cor Coef	56.71%
AACpTCp	1.798%	AACpTCp	1.824%	AACpTCp	1.839%	AACpTCp	1.841%	AACpTCp	1.847%
FDHA,"k" dks	3.442%	FDHA,"k" dks	3.377%	FDHA,"k" dks	3.329%	FDHA,"k" dks	3.323%	FDHA, infinite	3.305%
MDHA,"k" dks	-4.191%	MDHA,"k" dks	-0.326%	MDHA,"k" dks	2.119%	MDHA,"k" dks	2.418%	MDHA=FDHA	n/a
MT, "k" dks	3.184	MT, "k" dks	1.545	MT, "k" dks	0.505	MT, "k" dks	0.378	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.73**	Index, Idx	**1.31**	Index, Idx	**1.64**	Index, Idx	**1.68**	Index, Idx	**1.79**

Red 7 Indices
NDAS (No Double After Split)

Negative Correlation Coefficient and AACpTCp Count **Red 7** *Stand if (tc) >= Idx* Situation ***Split 8,8 v T, NDAS*** *(See Exhibit I1 for details)*

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-50.58%	Cor Coef	-51.09%	Cor Coef	-51.42%	Cor Coef	-51.46%	Cor Coef	-51.59%
AACpTCp	-0.941%	AACpTCp	-0.950%	AACpTCp	-0.956%	AACpTCp	-0.957%	AACpTCp	-0.960%
FDHA,"k" dks	-5.324%	FDHA,"k" dks	-5.115%	FDHA,"k" dks	-4.961%	FDHA,"k" dks	-4.941%	FDHA, infinite	-4.880%
MDHA,"k" dks	-6.070%	MDHA,"k" dks	-5.476%	MDHA,"k" dks	-5.079%	MDHA,"k" dks	-5.029%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**5.27**	Index, Idx	**5.19**	Index, Idx	**5.12**	Index, Idx	**5.11**	Index, Idx	**5.09**

Count **Red 7** Situation ***Split 9,9 v 7, NDAS***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	59.90%	Cor Coef	59.90%	Cor Coef	59.91%	Cor Coef	59.91%	Cor Coef	59.91%
AACpTCp	0.888%	AACpTCp	0.892%	AACpTCp	0.895%	AACpTCp	0.896%	AACpTCp	0.897%
FDHA,"k" dks	7.618%	FDHA,"k" dks	7.091%	FDHA,"k" dks	6.736%	FDHA,"k" dks	6.692%	FDHA, infinite	6.558%
MDHA,"k" dks	6.433%	MDHA,"k" dks	6.516%	MDHA,"k" dks	6.548%	MDHA,"k" dks	6.551%	MDHA=FDHA	n/a
MT, "k" dks	0.531	MT, "k" dks	0.257	MT, "k" dks	0.084	MT, "k" dks	0.063	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**7.65**	Index, Idx	**7.50**	Index, Idx	**7.38**	Index, Idx	**7.36**	Index, Idx	**7.31**

Red 7 Indices
NDAS (No Double After Split)

Count **Red 7** Situation ***Split 9,9 v A, NDAS, H17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	60.83%	Cor Coef	58.89%	Cor Coef	57.87%	Cor Coef	57.76%	Cor Coef	57.43%
AACpTCp	0.803%	AACpTCp	0.826%	AACpTCp	0.842%	AACpTCp	0.844%	AACpTCp	0.850%
FDHA,"k" dks	2.538%	FDHA,"k" dks	2.592%	FDHA,"k" dks	2.645%	FDHA,"k" dks	2.652%	FDHA, infinite	2.676%
MDHA,"k" dks	0.535%	MDHA,"k" dks	1.620%	MDHA,"k" dks	2.327%	MDHA,"k" dks	2.415%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-0.52**	Index, Idx	**1.39**	Index, Idx	**2.58**	Index, Idx	**2.72**	Index, Idx	**3.15**

Count **Red 7** Situation ***Split 9,9 v A, NDAS, S17***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	66.29%	Cor Coef	64.29%	Cor Coef	63.21%	Cor Coef	63.09%	Cor Coef	62.74%
AACpTCp	0.850%	AACpTCp	0.870%	AACpTCp	0.884%	AACpTCp	0.886%	AACpTCp	0.891%
FDHA,"k" dks	3.420%	FDHA,"k" dks	3.525%	FDHA,"k" dks	3.613%	FDHA,"k" dks	3.625%	FDHA, infinite	3.661%
MDHA,"k" dks	1.687%	MDHA,"k" dks	2.685%	MDHA,"k" dks	3.338%	MDHA,"k" dks	3.419%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**0.80**	Index, Idx	**2.51**	Index, Idx	**3.59**	Index, Idx	**3.72**	Index, Idx	**4.11**

RED 7 Summary Indices
LS

Situation	Red 7 Indices Rounded — Decks 1	2	6	8	Infinite	Red 7 Indices — Decks 1	2	6	8	Infinite
h17 v A, H17, Late Surrender	*0*	*1*	*2*	*2*	*2*	*0.02*	*0.96*	*1.59*	*1.66*	*1.90*
h 15 v 9, Late Surrender	4	3	3	3	3	3.15	2.73	2.45	2.42	2.32
h 15 v A, S17, Late Surrender	1	2	2	2	2	0.49	1.23	1.72	1.78	1.96
h 15 v A, H17, Late Surrender	-1	-1	0	0	0	-1.97	-1.37	-0.98	-0.94	-0.79
h 14 v 9, Late Surrender	7	7	6	6	6	6.57	6.10	5.79	5.76	5.64
8,8 v T DAS, Late Surrender	4	3	2	2	2	3.71	2.71	2.05	1.97	1.73
8,8 v T NDAS, Late Surrender	2	2	1	1	1	2.25	1.44	0.92	0.85	0.66
h 14 v T, Late Surrender	3	3	3	3	3	2.86	2.81	2.78	2.78	2.76
7,7 v T, Late Surrender	-1	1	2	2	3	-1.39	0.79	2.13	2.29	2.76
8,8 v A, H17, DAS, Late Surrender	*-4*	*-1*	*1*	*2*	*2*	*-4.21*	*-1.04*	*0.97*	*1.22*	*1.95*
8,8 v A, H17, NDAS, Late Surrender	*-4*	*0*	*2*	*2*	*3*	*-4.00*	*-0.44*	*1.78*	*2.05*	*2.85*
h 14 v A, S17, Late Surrender	5	5	6	6	6	4.30	5.15	5.72	5.79	6.00
h 14 v A, H17, Late Surrender	3	3	4	4	4	2.31	3.02	3.47	3.53	3.70
7,7 v A, H17, Late Surrender	-2	1	3	3	4	-2.88	0.54	2.67	2.93	3.70
h 16 v 8, Late Surrender	6	5	5	5	5	5.54	4.93	4.54	4.49	4.34

h17 v A, H17, Late Surrender	Negative Correlation Coefficient and AACpTCp	Surrender if true count <= Index, otherwise stand
8,8 v A, H17, DAS, Late Sur	Negative Correlation Coefficient and AACpTCp	Surrender if true count <= Index, otherwise split
8,8 v A, H17, NDAS, Late Sur	Negative Correlation Coefficient and AACpTCp	Surrender if true count <= Index, otherwise split

Late Surrender Indices

Dealer's Up Card

Player's Hand	S17: 8	S17: 9	S17: T	S17: A	H17: A
h17					2 *
h16	5	sur	sur	sur	sur
h15		3	sur	2	sur
h14			3		4
8,8			2		2 *
7,7			2		3

Under H17, h15 v A surrender become a basic strategy play. Table above for six and eight deck games.

* Under H17, h17 v A surrender become a basic strategy play but has a negative CC and AACpTCp and so if true count <= Idx then surrender, otherwise stand.

* Under H17, 8,8 v A surrender become a basic strategy play but has a negative CC and AACpTCp and so if true count <= Idx then surrender, otherwise split.

Red 7 Indices
Late Surrender

H17: Negative CC and AACpTCp Count **Red 7** Situation ***h17 v A, H17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-72.01%	Cor Coef	-71.67%	Cor Coef	-71.44%	Cor Coef	-71.41%	Cor Coef	-71.33%
AACpTCp	-0.843%	AACpTCp	-0.834%	AACpTCp	-0.827%	AACpTCp	-0.827%	AACpTCp	-0.824%
FDHA,"k" dks	-0.778%	FDHA,"k" dks	-1.175%	FDHA,"k" dks	-1.435%	FDHA,"k" dks	-1.467%	FDHA, infinite	-1.563%
MDHA,"k" dks	-0.908%	MDHA,"k" dks	-1.239%	MDHA,"k" dks	-1.456%	MDHA,"k" dks	-1.483%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**0.02**	Index, Idx	**0.96**	Index, Idx	**1.59**	Index, Idx	**1.66**	Index, Idx	**1.90**

MDHA < 0, Surrender hard 17 v A, H17 is a basic strategy play
Negative Correlation Coefficient and AACpTCp
Surrender h17 v A, H17 if true count <= Index
If true count >= Index then Stand

pa(t) = player's advantage at true count = "t": Surrender - Stand

pa(t) = AACpTCp * (t - Idx) ***pa(t) = AACpTCp * (t - Idx)*** ***pa(t) = AACpTCp * (t - Idx)*** ***pa(t) = AACpTCp * (t - Idx)*** ***pa(t) = AACpTCp * (t -***

k (# decks) =	1		k (# decks) =	2		k (# decks) =	6		k (# decks) =	8		k (# decks) =	infinite
Red 7	h17 v A, H17, late s		Red 7	h17 v A, H17, late s		Red 7	h17 v A, H17, late s		Red 7	h17 v A, H17, late s		Red 7	h17 v A, H
t	pa(t)		t	pa(t)		t	pa(t)		t	pa(t)		t	pa(t)
0	0.01%	sur	0	0.80%	sur	0	1.31%	sur	0	1.38%	sur	0	1.56%
1	-0.83%	std	1	-0.03%	std	1	0.48%	sur	1	0.55%	sur	1	0.74%
2	-1.67%	std	2	-0.86%	std	2	-0.34%	std	2	-0.28%	std	2	-0.09%
3	-2.51%	std	3	-1.70%	std	3	-1.17%	std	3	-1.10%	std	3	-0.91%
4	-3.36%	std	4	-2.53%	std	4	-2.00%	std	4	-1.93%	std	4	-1.73%
5	-4.20%	std	5	-3.37%	std	5	-2.82%	std	5	-2.76%	std	5	-2.56%

Count **Red 7** Situation ***h 15 v 9, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	77.04%	Cor Coef	76.89%	Cor Coef	76.80%	Cor Coef	76.78%	Cor Coef	76.75%
AACpTCp	1.226%	AACpTCp	1.227%	AACpTCp	1.227%	AACpTCp	1.227%	AACpTCp	1.227%
FDHA,"k" dks	2.927%	FDHA,"k" dks	2.884%	FDHA,"k" dks	2.856%	FDHA,"k" dks	2.853%	FDHA, infinite	2.842%
MDHA,"k" dks	3.913%	MDHA,"k" dks	3.372%	MDHA,"k" dks	3.018%	MDHA,"k" dks	2.974%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**3.15**	Index, Idx	**2.73**	Index, Idx	**2.45**	Index, Idx	**2.42**	Index, Idx	**2.32**

Red 7 Indices
Late Surrender

S17 Count **Red 7** Situation ***h 15 v A, S17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	64.32%	Cor Coef	63.88%	Cor Coef	63.61%	Cor Coef	63.57%	Cor Coef	63.47%
AACpTCp	1.048%	AACpTCp	1.034%	AACpTCp	1.025%	AACpTCp	1.024%	AACpTCp	1.020%
FDHA,"k" dks	1.622%	FDHA,"k" dks	1.813%	FDHA,"k" dks	1.938%	FDHA,"k" dks	1.953%	FDHA, infinite	1.999%
MDHA,"k" dks	1.624%	MDHA,"k" dks	1.814%	MDHA,"k" dks	1.938%	MDHA,"k" dks	1.953%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**0.49**	Index, Idx	**1.23**	Index, Idx	**1.72**	Index, Idx	**1.78**	Index, Idx	**1.96**

H17 Count **Red 7** Situation ***h 15 v A, H17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	61.94%	Cor Coef	61.53%	Cor Coef	61.27%	Cor Coef	61.24%	Cor Coef	61.14%
AACpTCp	0.894%	AACpTCp	0.882%	AACpTCp	0.875%	AACpTCp	0.874%	AACpTCp	0.871%
FDHA,"k" dks	-0.826%	FDHA,"k" dks	-0.754%	FDHA,"k" dks	-0.710%	FDHA,"k" dks	-0.705%	FDHA, infinite	-0.689%
MDHA,"k" dks	-0.814%	MDHA,"k" dks	-0.748%	MDHA,"k" dks	-0.708%	MDHA,"k" dks	-0.703%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**-1.97**	Index, Idx	**-1.37**	Index, Idx	**-0.98**	Index, Idx	**-0.94**	Index, Idx	**-0.79**

Count **Red 7** Situation ***h 14 v 9, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	74.92%	Cor Coef	74.74%	Cor Coef	74.62%	Cor Coef	74.60%	Cor Coef	74.56%
AACpTCp	1.223%	AACpTCp	1.224%	AACpTCp	1.224%	AACpTCp	1.224%	AACpTCp	1.224%
FDHA,"k" dks	6.937%	FDHA,"k" dks	6.923%	FDHA,"k" dks	6.912%	FDHA,"k" dks	6.911%	FDHA, infinite	6.907%
MDHA,"k" dks	8.084%	MDHA,"k" dks	7.491%	MDHA,"k" dks	7.101%	MDHA,"k" dks	7.052%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**6.57**	Index, Idx	**6.10**	Index, Idx	**5.79**	Index, Idx	**5.76**	Index, Idx	**5.64**

Red 7 Indices
Late Surrender

Count **Red 7** Situation ***8,8 v T DAS, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	62.91%	Cor Coef	63.33%	Cor Coef	63.59%	Cor Coef	63.62%	Cor Coef	63.72%
AACpTCp	1.100%	AACpTCp	1.106%	AACpTCp	1.110%	AACpTCp	1.111%	AACpTCp	1.112%
FDHA,"k" dks	2.893%	FDHA,"k" dks	2.423%	FDHA,"k" dks	2.094%	FDHA,"k" dks	2.053%	FDHA, infinite	1.926%
MDHA,"k" dks	5.385%	MDHA,"k" dks	3.631%	MDHA,"k" dks	2.489%	MDHA,"k" dks	2.348%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**3.71**	Index, Idx	**2.71**	Index, Idx	**2.05**	Index, Idx	**1.97**	Index, Idx	**1.73**

Count **Red 7** Situation ***8,8 v T NDAS, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	65.02%	Cor Coef	65.46%	Cor Coef	65.74%	Cor Coef	65.78%	Cor Coef	65.88%
AACpTCp	1.252%	AACpTCp	1.260%	AACpTCp	1.265%	AACpTCp	1.266%	AACpTCp	1.268%
FDHA,"k" dks	1.704%	FDHA,"k" dks	1.282%	FDHA,"k" dks	0.987%	FDHA,"k" dks	0.950%	FDHA, infinite	0.837%
MDHA,"k" dks	4.300%	MDHA,"k" dks	2.541%	MDHA,"k" dks	1.399%	MDHA,"k" dks	1.258%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**2.25**	Index, Idx	**1.44**	Index, Idx	**0.92**	Index, Idx	**0.85**	Index, Idx	**0.66**

Count **Red 7** Situation ***h 14 v T, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	72.47%	Cor Coef	72.77%	Cor Coef	72.97%	Cor Coef	72.99%	Cor Coef	73.06%
AACpTCp	1.212%	AACpTCp	1.215%	AACpTCp	1.216%	AACpTCp	1.217%	AACpTCp	1.217%
FDHA,"k" dks	3.249%	FDHA,"k" dks	3.310%	FDHA,"k" dks	3.347%	FDHA,"k" dks	3.351%	FDHA, infinite	3.365%
MDHA,"k" dks	4.752%	MDHA,"k" dks	4.054%	MDHA,"k" dks	3.593%	MDHA,"k" dks	3.536%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.86**	Index, Idx	**2.81**	Index, Idx	**2.78**	Index, Idx	**2.78**	Index, Idx	**2.76**

Red 7 Indices
Late Surrender

Count **Red 7** Situation ***7,7 v T, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	75.49%	Cor Coef	74.12%	Cor Coef	73.38%	Cor Coef	73.30%	Cor Coef	73.06%
AACpTCp	1.172%	AACpTCp	1.195%	AACpTCp	1.210%	AACpTCp	1.212%	AACpTCp	1.217%
FDHA,"k" dks	3.249%	FDHA,"k" dks	3.310%	FDHA,"k" dks	3.347%	FDHA,"k" dks	3.351%	FDHA, infinite	3.365%
MDHA,"k" dks	-1.489%	MDHA,"k" dks	1.011%	MDHA,"k" dks	2.595%	MDHA,"k" dks	2.789%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-1.39**	Index, Idx	**0.79**	Index, Idx	**2.13**	Index, Idx	**2.29**	Index, Idx	**2.76**

H17: Negative CC and AACpTCp Count **Red 7** Situation ***8,8 v A, H17, DAS, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-55.24%	Cor Coef	-54.06%	Cor Coef	-53.39%	Cor Coef	-53.32%	Cor Coef	-53.09%
AACpTCp	-1.228%	AACpTCp	-1.233%	AACpTCp	-1.237%	AACpTCp	-1.238%	AACpTCp	-1.240%
FDHA,"k" dks	-1.060%	FDHA,"k" dks	-1.736%	FDHA,"k" dks	-2.190%	FDHA,"k" dks	-2.247%	FDHA, infinite	-2.418%
MDHA,"k" dks	3.710%	MDHA,"k" dks	0.578%	MDHA,"k" dks	-1.434%	MDHA,"k" dks	-1.681%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-4.21**	Index, Idx	**-1.04**	Index, Idx	**0.97**	Index, Idx	**1.22**	Index, Idx	**1.95**

Negative Correlation Coefficient and AACpTCp
Surrender 8, 8 v A, DAS, H17 if true count <= Index
If true count >= Index then Split
Three or more decks: MDHA < 0: Surrender hard 8,8 v A, DAS, H17 becomes basic strategy

Count	Red 7	Count	Red 7
Situation	8,8 v A, H17, lsur - DAS (derived)	Situation	8,8 v A, H17, lsur - DAS (derived)
k (# decks) =	2	k (# decks) =	3
Cor Coef	-54.06%	Cor Coef	-53.72%
AACpTCp	-1.233%	AACpTCp	-1.235%
FDHA,"k" dks	-1.736%	FDHA,"k" dks	-1.963%
MDHA,"k" dks	0.578%	MDHA,"k" dks	-0.435%
MT, "k" dks	(0.515)	MT, "k" dks	(0.340)
YI, "k" decks	(0.0594)	YI, "k" decks	(0.0392)
Index, Idx	**-1.04**	Index, Idx	**-0.03**

Red 7 Indices
Late Surrender

H17: Negative CC and AACpTCp Count **Red 7** Situation ***8,8 v A, H17, NDAS, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-41.19%	Cor Coef	-40.58%	Cor Coef	-40.26%	Cor Coef	-40.23%	Cor Coef	-40.13%
AACpTCp	-0.823%	AACpTCp	-0.838%	AACpTCp	-0.848%	AACpTCp	-0.850%	AACpTCp	-0.854%
FDHA,"k" dks	-1.888%	FDHA,"k" dks	-2.152%	FDHA,"k" dks	-2.336%	FDHA,"k" dks	-2.359%	FDHA, infinite	-2.431%
MDHA,"k" dks	2.315%	MDHA,"k" dks	-0.113%	MDHA,"k" dks	-1.669%	MDHA,"k" dks	-1.861%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-4.00**	Index, Idx	**-0.44**	Index, Idx	**1.78**	Index, Idx	**2.05**	Index, Idx	**2.85**

Negative Correlation Coefficient and AACpTCp

Surrender 8, 8 v A, NDAS, H17 if true count <= Index

If true count >= Index then Split

Two or more decks: MDHA < 0: Surrender hard 8,8 v A, NDAS, H17 becomes basic strategy

Count	Red 7	Count	Red 7
Situation	8,8 v A, H17,lsur - NDAS (derived)	Situation	8,8 v A, H17,lsur - NDAS (derived)
k (# decks) =	1	k (# decks) =	2
Cor Coef	-41.19%	Cor Coef	-40.58%
AACpTCp	-0.823%	AACpTCp	-0.838%
FDHA,"k" dks	-1.888%	FDHA,"k" dks	-2.152%
MDHA,"k" dks	2.315%	MDHA,"k" dks	-0.113%
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)
YI, "k" decks	(0.1224)	YI, "k" decks	(0.0594)
Index, Idx	**-4.00**	Index, Idx	**-0.44**

S17 Count **Red 7** Situation ***h 14 v A, S17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	63.72%	Cor Coef	63.29%	Cor Coef	63.01%	Cor Coef	62.98%	Cor Coef	62.88%
AACpTCp	1.027%	AACpTCp	1.013%	AACpTCp	1.005%	AACpTCp	1.004%	AACpTCp	1.000%
FDHA,"k" dks	5.502%	FDHA,"k" dks	5.755%	FDHA,"k" dks	5.919%	FDHA,"k" dks	5.939%	FDHA, infinite	5.999%
MDHA,"k" dks	5.500%	MDHA,"k" dks	5.754%	MDHA,"k" dks	5.918%	MDHA,"k" dks	5.939%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**4.30**	Index, Idx	**5.15**	Index, Idx	**5.72**	Index, Idx	**5.79**	Index, Idx	**6.00**

Red 7 Indices
Late Surrender

H17 Count **Red 7** Situation ***h 14 v A, H17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	59.22%	Cor Coef	58.83%	Cor Coef	58.58%	Cor Coef	58.55%	Cor Coef	58.46%
AACpTCp	0.861%	AACpTCp	0.850%	AACpTCp	0.842%	AACpTCp	0.841%	AACpTCp	0.839%
FDHA,"k" dks	2.893%	FDHA,"k" dks	3.002%	FDHA,"k" dks	3.071%	FDHA,"k" dks	3.079%	FDHA, infinite	3.104%
MDHA,"k" dks	2.904%	MDHA,"k" dks	3.008%	MDHA,"k" dks	3.073%	MDHA,"k" dks	3.081%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**2.31**	Index, Idx	**3.02**	Index, Idx	**3.47**	Index, Idx	**3.53**	Index, Idx	**3.70**

H17 Count **Red 7** Situation ***7,7 v A, H17, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	60.58%	Cor Coef	59.39%	Cor Coef	58.74%	Cor Coef	58.67%	Cor Coef	58.46%
AACpTCp	0.824%	AACpTCp	0.832%	AACpTCp	0.836%	AACpTCp	0.837%	AACpTCp	0.839%
FDHA,"k" dks	2.893%	FDHA,"k" dks	3.002%	FDHA,"k" dks	3.071%	FDHA,"k" dks	3.079%	FDHA, infinite	3.104%
MDHA,"k" dks	-2.273%	MDHA,"k" dks	0.497%	MDHA,"k" dks	2.252%	MDHA,"k" dks	2.467%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.122)	YI, "k" decks	(0.059)	YI, "k" decks	(0.019)	YI, "k" decks	(0.015)	YI = 0	n/a
Index, Idx	**-2.88**	Index, Idx	**0.54**	Index, Idx	**2.67**	Index, Idx	**2.93**	Index, Idx	**3.70**

Count **Red 7** Situation ***h 16 v 8, Late Surrender***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	64.24%	Cor Coef	64.12%	Cor Coef	64.04%	Cor Coef	64.03%	Cor Coef	64.00%
AACpTCp	0.956%	AACpTCp	0.956%	AACpTCp	0.957%	AACpTCp	0.957%	AACpTCp	0.957%
FDHA,"k" dks	4.384%	FDHA,"k" dks	4.268%	FDHA,"k" dks	4.193%	FDHA,"k" dks	4.184%	FDHA, infinite	4.156%
MDHA,"k" dks	5.330%	MDHA,"k" dks	4.736%	MDHA,"k" dks	4.348%	MDHA,"k" dks	4.300%	MDHA=FDHA	n/a
MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT, "k" dks	-	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Index, Idx	**5.54**	Index, Idx	**4.93**	Index, Idx	**4.54**	Index, Idx	**4.49**	Index, Idx	**4.34**

Technical Section

Red 7 Index for NOT splitting 8,8 v Ten

Effects of Removal from Blackjack Attack, 3rd Edition (BJA3) and Theory of Blackjack (ToBJ)

DAS = Double After Split

NDAS = No Double After Split

Effects of Removal *(in percent)* ***Reformatted***

Source	Situation	2	3	4	5	6	7	8	9	X	A	"m1" column single deck Full Deck House Adv	Sum EoR	ss Sum Sq's EoR
BJA3	8,8 v T NDAS	-1.4436	-1.3290	1.9926	2.7534	-1.5951	-2.4457	-0.4875	1.2084	0.6893	-1.4109	-5.7702	-0.0002	29.5167
ToBJ	8,8 v T NDAS	-1.7900	-2.2300	0.1300	0.0900	0.0500	-3.1600	-0.5500	1.8000	1.9000	-1.9300	-4.4100	0.0100	39.8975
Difference	8,8 v T NDAS	0.3464	0.9010	1.8626	2.6634	-1.6451	0.7143	0.0625	-0.5916	-1.2107	0.5191	-1.3602	-0.0102	-10.3808
Note: Difference 8,8 T NDAS of BJA3 and ToBJ gives stand - hit for hard 16 v T which is in very good agreement with BJA3 and ToBJ h16 v T.														
BJA3	h16 v T	0.2903	0.8042	1.7279	2.5683	-1.6446	0.7109	0.0567	-0.5524	-1.1151	0.4992	-0.4459	0.0001	19.0543
ToBJ	h16 v T	0.2900	0.8000	1.7300	2.5700	-1.6500	0.7100	0.0600	-0.5500	-1.1200	0.4900	-0.4500	-0.0300	19.1123
Difference	h16 v T	0.0003	0.0042	-0.0021	-0.0017	0.0054	0.0009	-0.0033	-0.0024	0.0049	0.0092	0.0041	0.0301	-0.0580

8,8 v T NDAS (No Double After Split)

For splitting:

EoR = Split - Basic Strategy. h16 v T basic strategy is to hit. BJA3 uses basic strategy of hit but ToBJ uses stand for 8,8 v T.

(1) BJA3 EoR: split - hit:

(2) ToBJ EoR: split - stand:

So:

BJA3 EoR - ToBJ EoR: stand - hit

But h16 v T EoR is for stand - hit.

Effects of Removal *(in percent)* ***Reformatted***

Source	Situation	2	3	4	5	6	7	8	9	X	A	"m1" column single deck Full Deck House Adv	
BJA3	8,8 v T NDAS	-1.4436	-1.3290	1.9926	2.7534	-1.5951	-2.4457	-0.4875	1.2084	0.6893	-1.4109	-5.7702	split - hit
ToBJ	8,8 v T NDAS	-1.7900	-2.2300	0.1300	0.0900	0.0500	-3.1600	-0.5500	1.8000	1.9000	-1.9300	-4.4100	split - stand
Difference	8,8 v T NDAS	0.3464	0.9010	1.8626	2.6634	-1.6451	0.7143	0.0625	-0.5916	-1.2107	0.5191	-1.3602	stand - hit
BJA3	h16 v T	0.2903	0.8042	1.7279	2.5683	-1.6446	0.7109	0.0567	-0.5524	-1.1151	0.4992	-0.4459	stand - hit

Adjusted BJA3 EoR making difference Split - Stand:

Source	Situation	2	3	4	5	6	7	8	9	X	A	Full Deck House Adv	
BJA3	8,8 v T NDAS	-1.4436	-1.3290	1.9926	2.7534	-1.5951	-2.4457	-0.4875	1.2084	0.6893	-1.4109	-5.7702	split - hit
BJA3	h16 v T	0.2903	0.8042	1.7279	2.5683	-1.6446	0.7109	0.0567	-0.5524	-1.1151	0.4992	-0.4459	stand - hit
Difference	8,8 v T NDAS	-1.7339	-2.1332	0.2647	0.1851	0.0495	-3.1566	-0.5442	1.7608	1.8044	-1.9101	-5.3243	split - stand

Red 7 Index for NOT splitting 8,8 v Ten

Negative Correlation Coefficient and AACpTCp	Count	**Red 7**	*Stand if (tc) >= Idx*	Situation	***Split 8,8 v T, NDAS***

Count	Red 7	Count	Red 7	Count	Red 7	Count	Red 7	Count	Red 7
Situation	8,8 v T NDAS: split-std	Situation	8,8 v T NDAS: split-std	Situation	8,8 v T NDAS: split-std	Situation	8,8 v T NDAS: split-std	Situation	8,8 v T NDAS: split-std
k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-50.58%	Cor Coef	-51.09%	Cor Coef	-51.42%	Cor Coef	-51.46%	Cor Coef	-51.59%
AACpTCp	-0.941%	AACpTCp	-0.950%	AACpTCp	-0.956%	AACpTCp	-0.957%	AACpTCp	-0.960%
FDHA,"k" dks	-5.324%	FDHA,"k" dks	-5.115%	FDHA,"k" dks	-4.961%	FDHA,"k" dks	-4.941%	FDHA, infinite	-4.880%
MDHA,"k" dk	-6.070%	MDHA,"k" dk	-5.476%	MDHA,"k" dks	-5.079%	MDHA,"k" dk	-5.029%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.1224)	YI, "k" decks	(0.0594)	YI, "k" decks	(0.0194)	YI, "k" decks	(0.0145)	YI = 0	n/a
Prop Defl Id	**5.27**	Prop Defl Id	**5.19**	Prop Defl Idx	**5.12**	Prop Defl Id	**5.11**	Index, Idx	**5.09**

pa(t) = AACpTCp * (t - Idx)

(pa = player's advantage, t = true count, Idx = Index, FDHA = Full Deck House Advantage)

pa(t) = AACpTCp * (t - Idx) (k = 1, 2, 6, 8)

pa(t) = AACpTCp * (t - Idx) = AACpTCp * t - FDHA (k = infinite)

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Red 7	8,8 v T NDAS: split-std	Red 7	8,8 v T NDAS: split-std	Red 7	8,8 v T NDAS: split-std	Red 7	8,8 v T NDAS: split-std	Red 7	8,8 v T NDAS: split-std
t	pa(t)	t	pa(t)	t	pa(t)	t	pa(t)	t	pa(t)
0	4.96%	0	4.93%	0	4.90%	0	4.89%	0	4.88%
1	4.01%	1	3.98%	1	3.94%	1	3.94%	1	3.92%
2	3.07%	2	3.03%	2	2.99%	2	2.98%	2	2.96%
3	2.13%	3	2.08%	3	2.03%	3	2.02%	3	2.00%
4	1.19%	4	1.13%	4	1.07%	4	1.07%	4	1.04%
5	0.25%	5	0.18%	5	0.12%	5	0.11%	5	0.08%
6	-0.69%	6	-0.77%	6	-0.84%	6	-0.85%	6	-0.88%
7	-1.63%	7	-1.72%	7	-1.80%	7	-1.81%	7	-1.84%
8	-2.57%	8	-2.67%	8	-2.75%	8	-2.76%	8	-2.80%
9	-3.51%	9	-3.62%	9	-3.71%	9	-3.72%	9	-3.76%

Red 7 Index for NOT splitting 8,8 v Ten

8,8 v T DAS (Double After Split)

Adjusted BJA3 EoR making difference Split - Stand:

Source	Situation	2	3	4	5	6	7	8	9	X	A	"m6" column Six decks Full Deck House Adv	
BJA3	8,8 v T DAS	-1.2669	-1.4920	2.1617	2.9814	-1.4196	-2.1425	-0.3796	1.1371	0.3733	-1.0730	-6.0912	split - hit
BJA3	h16 v T	0.2903	0.8042	1.7279	2.5683	-1.6446	0.7109	0.0567	-0.5524	-1.1151	0.4992	-0.0233	stand - hit
Difference	8,8 v T DAS	-1.5572	-2.2962	0.4338	0.4131	0.2250	-2.8534	-0.4363	1.6895	1.4884	-1.5722	-6.0679	split - stand

Negative Correlation Coefficient and AACpTCp Count **Red 7** *Stand if (tc) >= Idx* Situation ***Split 8,8 v T, DAS***

Count	Red 7	Count	Red 7	Count	Red 7	Count	Red 7	Count	Red 7
Situation	8,8 v T DAS: split-std	Situation	8,8 v T DAS: split-std	Situation	8,8 v T DAS: split-std	Situation	8,8 v T DAS: split-std	Situation	8,8 v T DAS: split-std
k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	-46.93%	Cor Coef	-47.44%	Cor Coef	-47.78%	Cor Coef	-47.82%	Cor Coef	-47.94%
AACpTCp	-0.789%	AACpTCp	-0.796%	AACpTCp	-0.801%	AACpTCp	-0.802%	AACpTCp	-0.804%
FDHA,"k" dks	-6.514%	FDHA,"k" dks	-6.256%	FDHA,"k" dks	-6.068%	FDHA,"k" dks	-6.043%	FDHA, infinite	-5.969%
MDHA,"k" dk	-7.155%	MDHA,"k" dk	-6.567%	MDHA,"k" dks	-6.170%	MDHA,"k" dk	-6.120%	MDHA=FDHA	n/a
MT, "k" dks	(1.061)	MT, "k" dks	(0.515)	MT, "k" dks	(0.168)	MT, "k" dks	(0.126)	MT = 0	n/a
YI, "k" decks	(0.1224)	YI, "k" decks	(0.0594)	YI, "k" decks	(0.0194)	YI, "k" decks	(0.0145)	YI = 0	n/a
Prop Defl Id	**7.89**	Prop Defl Id	**7.67**	Prop Defl Idx	**7.51**	Prop Defl Id	**7.49**	Index, Idx	**7.43**

pa(t) = AACpTCp * (t - Idx)

(pa = player's advantage, t = true count, Idx = Index, FDHA = Full Deck House Advantage)

pa(t) = AACpTCp * (t - Idx) (k = 1, 2, 6, 8)

pa(t) = AACpTCp * (t - Idx) = AACpTCp * t - FDHA (k = infinite)

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Red 7	8,8 v T DAS: split-std	Red 7	8,8 v T DAS: split-std	Red 7	8,8 v T DAS: split-std	Red 7	8,8 v T DAS: split-std	Red 7	8,8 v T DAS: split-std
t	pa(t)	t	pa(t)	t	pa(t)	t	pa(t)	t	pa(t)
0	6.22%	0	6.11%	0	6.02%	0	6.01%	0	5.97%
1	5.43%	1	5.31%	1	5.22%	1	5.20%	1	5.17%
2	4.64%	2	4.52%	2	4.42%	2	4.40%	2	4.36%
3	3.85%	3	3.72%	3	3.62%	3	3.60%	3	3.56%
4	3.07%	4	2.92%	4	2.81%	4	2.80%	4	2.75%
5	2.28%	5	2.13%	5	2.01%	5	2.00%	5	1.95%
6	1.49%	6	1.33%	6	1.21%	6	1.20%	6	1.15%
7	0.70%	7	0.53%	7	0.41%	7	0.39%	7	0.34%
8	-0.09%	8	-0.26%	8	-0.39%	8	-0.41%	8	-0.46%
9	-0.88%	9	-1.06%	9	-1.19%	9	-1.21%	9	-1.27%

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Count	Red 7	k = # of Decks, k_decks	6
Situation	8,8 v T DAS: split-std (derived)	Player's Up Card #1, puc1	8
		Player's Up Card #2, puc2	8
		Dealer's Up Card, duc	T

Card	(1) X Red 7 Count	(2) x= X - uX	(3) Y (a) Effect of Removal	(4) y = Y - uY	(5) F = freq "k" deck # of cards	(6) = (5)*(2)*(4) F*x*y	(7) = (5)*(2)^2 F*x^2	(8) = (5)*(4)^2 F*y^2
2	1.00	0.9579	-1.5572%	-1.5552%	24.00	-35.7541%	22.0231	0.5805%
3	1.00	0.9579	-2.2962%	-2.2942%	24.00	-52.7440%	22.0231	1.2632%
4	1.00	0.9579	0.4338%	0.4358%	24.00	10.0195%	22.0231	0.0456%
5	1.00	0.9579	0.4131%	0.4151%	24.00	9.5436%	22.0231	0.0414%
6	1.00	0.9579	0.2250%	0.2270%	24.00	5.2192%	22.0231	0.0124%
Red 7	1.00	0.9579	-2.8534%	-2.8514%	12.00	-32.7771%	11.0115	0.9756%
Black 7	0.00	-0.0421	-2.8534%	-2.8514%	12.00	1.4395%	0.0212	0.9756%
8	0.00	-0.0421	-0.4363%	-0.4343%	22.00	0.4020%	0.0389	0.0415%
9	0.00	-0.0421	1.6895%	1.6915%	24.00	-1.7079%	0.0425	0.6867%
10	-1.00	-1.0421	1.4884%	1.4904%	23.75	-36.8866%	25.7904	0.5276%
J	-1.00	-1.0421	1.4884%	1.4904%	23.75	-36.8866%	25.7904	0.5276%
Q	-1.00	-1.0421	1.4884%	1.4904%	23.75	-36.8866%	25.7904	0.5276%
K	-1.00	-1.0421	1.4884%	1.4904%	23.75	-36.8866%	25.7904	0.5276%
A	-1.00	-1.0421	-1.5722%	-1.5702%	24.00	39.2698%	26.0619	0.5917%
Total (b)	13.00	0.0000	-0.6159%	0.0000%	309.00	-204.6358%	250.4531	7.3244%
mu = mean (c)	0.0421	0.0000	-0.0020%	0.0000%				

(a) Y = single deck EoR. If no cards are removed then "Y" does not have to be adjusted for various number of decks for Correlation Coefficient calculation since if "Y" is multiplied by any constant, that constant will cancel out when CC is calculated. (but if cards are removed then CC will vary by decks per Frequency of cards, col (5)). CC = Sum(F*x*y) / SQRT [Sum(F*x^2) * Sum(F*y^2)]

(b) Tot(col (A)) = Sumproduct(Col (A), Col (5)) where A = (1), (2), (3) or (4).

(c) Mean(col (A)) = Tot(Col (A)) / Tot(Col (5)) where A = (1), (2), (3) or (4).

Corr Coef = Sum(F*x*y) / SQRT [Sum(F*x^2) * Sum(F*y^2)] = Tot (6) / SQRT [Tot (7) * Tot (8)] {note: CC is dimensionless} -47.78%

m = slope = Sum(F*x*y) / Sum (F*x^2) = Tot (6) / Tot (7) {note: dim [slope] = dim (x*y) / dim(x^2) = dim(y) / dim(x) = rise / run} -0.817%

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

m = Slope of generalized Least Square Line (LSL), Y = mX + b, Y = EoR and X = count tag values

One deck EoR, "y", weighted with "x" tag values and "k" deck card distribution of remaining cards

Definitions of Slope and EoR:

Slope = Change (EoR) / Change (Tag Value) = Change(EoR) per unit change in the tag values for the given count.

EoR(c) = EV(51 cards remaining after removal of card "c") - EV(52 cards), EV(52 cards) = constant for given situation. (See Exhibit 5).

Change(EoR) = EV(51 cards, tag value = (tv+1)) - EV(51 cards, tag value = tv) = slope of LSL through EoR and Tag Values.

So EoR and therefore the slope "m" are based on 51 cards and the slope is the average change in EoR per unit Tag Value

if AAC = average advantage change, then m = slope of LSL = (AAC / 51 cards) and AACpTCp = AAC / deck = AAC / 52 cards

So AACpTCp = (AAC / deck) = (AAC / 52 cards) = (AAC / 51 cards) * (51 cards / 52 cards) = m * (51/ 52)

b = "k" deck LSL Y-intercept, b = uY - m*u X (not used in Index calculation)	0.0324%		
k = number of decks = k_decks	6		
n = number of cards removed = n_out	3		
AACpTCp = m * [(51) / (52)]		*card removed*	-0.801%
EoR(puc1, single deck): (if positive: increases player advantage = decreases house advantage)		8	-0.436% *(a1)*
EoR(puc2, single deck): (if positive: increases player advantage = decreases house advantage)		8	-0.436% *(a2)*
EoR(duc, single deck): (if positive: increases player advantage = decreases house advantage)		T	1.488% *(a3)*
EoR(n cards removed, k decks) = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)] (See Exhibit 5)			0.102%
FDHA = Full Deck House Advantage for "k" decks (See Exhibit 5)			-6.068%
MDHA = Modified Deck House Advantage = FDHA - EoR(n cards removed, k decks)			-6.170%
T = Sum { Tagged value of removed cards: (puc1, puc2, duc) }			-1.000
MT = Modified Tagged value = T * [52 / (52*k - n)], k = # decks, n = # of cards removed			-0.168

MT = Sum (Tag Values of Cards Removed) / (Decks Remaining) = [Sum (Tags Removed) / Cards Remaining] * [52 cards / deck]
= [Sum (Tags Removed) / (52*k - n)] * [52 cards / deck] = Sum (Tags Removed) * [52 / (52*k - n)]

If dr = decks remaining and cr = cards remaining then cr = 52*dr and dr = (cr/52). Also cr = (52*k - n) so
MT = Sum(Tags Removed) / dr = Sum(Tags Removed) / (cr/52) = 52 * Sum(Tags Removed) / cr
= 52 * Sum(Tags Removed) / (52*k - n) = [52 / (52*k - n)] * Sum(Tags Removed)

Idx = Index = { MDHA / AACpTCp } + MT *7.5307*

Notes:

(a1) =IF(puc1="n/a",0,VLOOKUP(srn,EoR,MATCH(duc,EoR_header,0))/100). (a2) and (a3) calculated similarly.

Exhibit I2 - Finite Deck Red 7 Least Squares Line Sample Index Calculation for 8,8 v T

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Adjustment to Index

Method 1

This adjustment is zero for balanced counts (b:inf = 0), no cards removed (n = 0), or infinite number of decks (k = infinity):

Let YI = infinite deck Y-Intercept adjustment

b:inf = infinite deck LSL Y-intercept (See Exhibit 3)	0.0315%	
AACpTCp:inf = infinite deck AACpTCp (See Exhibit 3)	-0.8038%	
k = number of decks = k_decks	6	
n = number of cards removed = n_out = cp = cards played	3	
YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }		-0.0194 *(b)*

Method 2

This adjustment is zero for balanced counts (u = 0), no cards removed (n = 0), or infinite number of decks (k = infinity)

uX:full deck = mean(X)= Sum(X) / # cards (Exhibit 3, Col (1), mean)	0.03846	*Red 7*
Unbalance per Deck = u = uX * 52 cards	2.00	(also see Exhibit 4, last page, column (1a), Tot)
k = number of decks = k_decks	6	
n = number of cards removed = n_out = cp = cards played	3	
YI = (-1) * ((u * dp) / dr) = (-1) * ((u * cp) / cr) = (-1) * u * { n / (52*k - n) }		-0.0194 *(c)*
Idx = Index = { MDHA / AACpTCp } + MT + YI		***7.5112***

(b) **YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }**

b:inf = infinite deck change in expectation per 51 cards since b:inf is part of infinite deck LSL equation: Y = m*X + b where Y = EoR

b:inf * [51 / (52*k - n) = change in expectation per card for k decks and n cards removed (cards remaining = 52*k - n)

b:inf * [51 / (52*k - n) / AACpTCp:inf = change in true count per card removed (dimensions: (expectation / card) / (expectation / true count) = true count / card

YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = true count adjustment when "n" cards removed.

(c) **YI = (-1) * ((u * dp) / dr) = (-1) * ((u * cp) / cr) = (-1) * u * { n / (52*k - n) }**

where u = unbalance per deck, cp = cards played = n = n_out, cr = cards remaining, dp = decks played = 52*cp, dr = decks remaining = 52*cr

u*dp = unbalance in running count when "dp" decks played, u*dp / dr = unbalance in true count when "dp" decks played

T = Sum { Tagged value of removed cards: (puc1, puc2, duc) } shown above. If count is unbalanced, then T must be modified to what an equivalent balanced count tagged values removed would be. This would be then T - u*(dp). This running count tag adjustment must then be adjusted to a true count basis so the total tag adjustment would be (T - u*(dp)) / dr = (T/dr) - (u*(dp) / dr) = MT + YI

Index = (MDHA /AACpTCp) + MT + YI = (MDHA/AACpTCp) + (T - u*dp)/dr

where MDHA = FHDA - EoR(cp,k), cp = cards played, k = number of decks

AACpTCp = {(Slope of LSL(EoR,X)}*(51/52) where X = tag values of count

and MT + YI = (T - u*(dp)) / dr = total true count Index adjustment for tags removed

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

*Prove YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = (-1) * u * { n / (52*k - n) }*

b:inf = uY - m*u X = infinite deck LSL Y- intercept:

uY = mean Y where Y = EoR, since Sum(Y) = 0 then uY = 0

uX = mean (X) = (Sum(X) / card) and u = Unbalance per Deck = uX * 52

so b:inf = uY - m*uX = 0 - m * (u/52) = (-1) * m * (u/52)

AACpTCp:inf = m * (51/52)

YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }

YI = n * { (-1) * m * (u/52) } * [51 / (52*k - n)] / { m * (51/52) }

YI = (-1) * u * { n / (52*k - n) } where n = cards out and (52*k - n) = cards remaining and u = unbalance per deck

*Prove true count corresponding to a running count of "T" and "dp" decks played is (T - u*dp)/dr = MT + YI*

dp = decks played, dr = decks remaining, n = number of decks, u = unbalance per deck, tc = true count, rc = running count = tags removed (T),

T = Sum { Tagged value of removed cards: (puc1, puc2, duc) } = running count which needs to be converted to a true count and added to Index.

tc = u + (rc - u*n)/dr where n = number of decks = dp + dr and rc = T then the corresponding tc = u + (T - u*(dp + dr))/dr = (T - u*dp)/dr

So (T - u*dp)/dr is the true count corresponding to the tags removed which must be added to the "raw" index (MDHA/AACpTCp) to give final index.

*Prove (T - u*dp)/dr = MT + YI so that Index = (MDHA / AACpTCp) + (T - u*dp)/dr*

dp = decks played, dr = decks remaining, n = number of decks = (dp + dr), u = unbalance per deck,

cp = cards played = 52*dp, cr = cards remaining = 52*dr, T = running count tags removed, tc = true count

(T - u*dp)/dr = T/dr - u*dp/dr = MT + YI: (formulas for MT and YI above use "k" for # of decks and "n" for cards played)

T /dr = T/(cr/52) = (T*52)/cr = (T*52)/(52*n - cp) = T*(52/(52*n - cp)) = MT

(-1)*u*dp/dr = (-1)*u*cp/cr = (-1)*u*cp/(52*n - cp) = YI

Indices using generalized LSL line.

(1) AACpTCp = m * [(51) / (52)], m = slope of generalized LSL through EoR and Tagged Values of Count under consideration

(2) EoR(n cards removed, k decks) = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)], puc = player's up card, duc = dealer's up card

(3) FDHA = Full Deck House Advantage. Estimated for "k" decks through Cubic Interpolation by Reciprocals (See Exhibit 5).

[For insurance and over/under 13 bet, FDHA does not vary by deck]

(4) MDHA = Modified Deck House Advantage = FDHA - EoR(n cards removed, k decks)

(5) MT = Modified Tag = Sum (Tags Removed) * [52 / (52*k - n)]

(6) YI = infinite deck Y-intercept adjustment = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = (-1) * u * { n / (52*k - n) }

(7) Idx = Index = { MDHA / AACpTCp } + MT + YI

(8) pa(t) = AACpTCp * (t - Idx), where pa(t) = player's advantage at true count "t". See Exhibit 7 for explanation.

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Full Deck House Advantage (FDHA) calculated for "k" decks
Removal of Dealer's up card (and Player's up cards when available) TAKEN into consideration
"k" decks used in the calculation of Correlation Coefficient, AACpTCp and Critical Index

crn	Count Reference #	1		Count	**Red 7**
srn	Situation Reference #	52		Situation	**8,8 v T DAS: split-std (derived)**
k_decks	***Number of Decks = k***	***6***	***puc1***	***Player's Up Card #1***	***8***
			puc2	***Player's Up Card #2***	***8***
			duc	***Dealer's Up Card***	***T***

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				= (2) + (3) + (4)			= (7) * (5)	
Cards Removed	Player's Up Card 1 puc1	Player's Up Card 2 puc2	Dealer's Up Card duc	Total Cards Removed	Variable Name	Tagged Value in Count (1)	Tagged Value * Total Removed	Variable Name
2	0	0	0	0	out_2	1.0	0	n/a
3	0	0	0	0	out_3	1.0	0	n/a
4	0	0	0	0	out_4	1.0	0	n/a
5	0	0	0	0	out_5	1.0	0	n/a
6	0	0	0	0	out_6	1.0	0	n/a
7	0	0	0	0	out_7	0.5	0	n/a
8	1	1	0	2	out_8	0.0	0	n/a
9	0	0	0	0	out_9	0.0	0	n/a
T	0	0	1	1	out_T	-1.0	-1	n/a
A	0	0	0	0	out_A	-1.0	0	n/a
Total	n/a	n/a	n/a	**3**	n_out	n/a	**-1**	sum_tags_out

Notes:

(1) tagged value of 7 taken as the average tag value of Red 7 and Black 7, so for the Red 7, (1+0)/2 = 0.5, since if a 7 is removed it could be either the Red 7 or Black 7.

Infinite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Full Deck House Advantage (FDHA) calculated for infinite decks
Removal of Dealer's and Player's up cards NOT taken into consideration
Infinite Deck assumption in calculation of CC, AACpTCp and Crit. Index

Card	X Red 7 Count	Y Effect of Removal
Red 2	1	-1.5572%
Black 2	1	-1.5572%
Red 3	1	-2.2962%
Black 3	1	-2.2962%
Red 4	1	0.4338%
Black 4	1	0.4338%
Red 5	1	0.4131%
Black 5	1	0.4131%
Red 6	1	0.2250%
Black 6	1	0.2250%
Red 7	1	-2.8534%
Black 7	0	-2.8534%
Red 8	0	-0.4363%
Black 8	0	-0.4363%
Red 9	0	1.6895%
Black 9	0	1.6895%
Red 10	-1	1.4884%
Black 10	-1	1.4884%
Red J	-1	1.4884%
Black J	-1	1.4884%
Red Q	-1	1.4884%
Black Q	-1	1.4884%
Red K	-1	1.4884%
Black K	-1	1.4884%
Red A	-1	-1.5722%
Black A	-1	-1.5722%
Total	1.0000	0.0000%
mu = mean	0.0385	0.0000%
SD = STDDEVP(X-array)		0.8979
CC = CORREL(Y-array, X-array)		-47.94%
m = slope = SLOPE(Y-array, X-array)		-0.820%
AACpTCp = m * (51/52) (See Exhibit 2)		-0.804%
Full Dk House Adv (FDHA), infinite dks		-5.969% (Exhibit 5)
Index (FDHA / AACpTCp)		***7.43*** *(Infinite deck assumption)*

Count **Red 7**
Situation **8,8 v T DAS: split-std (derived)**

Indices using generalized LSL line
Infinite Deck Assumption (k = infinity):

(1) AACpTCp = m * [(51) / (52)],
m = slope of generalized LSL with each of the 13 card denominations weighted equally.
(2) EoR(n cards removed, k decks) = 0
(3) FDHA infinite decks: See Exhibit 5
(4) MDHA = FDHA
(5) MT = Modified Tag = 0
(6) Idx = Index = FDHA / AACpTCp
(7) pa(t) = AACpTCp * (t - Idx) = AACpTCp * t - FDHA

Calculation of Y-intercept of LSL

b = Y-intercept of LSL, Y = m*X + b
b = uY - m*u X = 0.0315%
b = Intercept(Y-array, X-array) = 0.0315%

Exhibit I3 - Infinite Deck Red 7 Least Squares Line Sample Index Calculation for 8,8 v T

Finite Deck Calculation of Indices
Proportional Deflection

Proportional Deflection:

Count	Red 7	Situation	8,8 v T DAS: split-std (derived)
k = # of Decks, k_decks	6	Player's Up Card #2, puc2	8
Player's Up Card #1, puc1	8	Dealer's Up Card, duc	T
n = number of cards removed	3		

If rc = running count, cr = cards remaining, dr = decks remaining

tc = rc / dr — So tc' = rc / cr = rc / (52*dr) = (rc / dr) * (1/52)

tc' = rc / cr — So tc' = tc * (1/52)

cr = 52*dr — So tc' = (1/52) corresponds to tc = 1.0

k = # of decks
6

tc =	7.6989
tc' = (tc/52) =	0.1481

Calculated BALANCED "tc" (Col (2))
giving Expected Value = 0 as shown below.

Card	(1) **X** Red 7 Count	(2) **x=** X - uX *Balanced Count*	(3) F = freq k decks # of cards	(4) SS(x) = Sum Squares F*x^2	(5) "tc" Estimated # of cards removed (c)	(6) = (3) - (5) "tc" Est. # of cards remaining	(7) **Y** Effect of Removal (EoR)	(8) EoR(k,n) = 51 / (52*k - n) * EoR	(9) =(5) * (8) "tc = t" EoR removed cards
2	1.00	0.9579	24.00	22.0231	4.1996	19.8004	-1.5572%	-0.2570%	-1.0793%
3	1.00	0.9579	24.00	22.0231	4.1996	19.8004	-2.2962%	-0.3790%	-1.5916%
4	1.00	0.9579	24.00	22.0231	4.1996	19.8004	0.4338%	0.0716%	0.3007%
5	1.00	0.9579	24.00	22.0231	4.1996	19.8004	0.4131%	0.0682%	0.2863%
6	1.00	0.9579	24.00	22.0231	4.1996	19.8004	0.2250%	0.0371%	0.1560%
Red 7	1.00	0.9579	12.00	11.0115	2.0998	9.9002	-2.8534%	-0.4709%	-0.9889%
Black 7	0.00	-0.0421	12.00	0.0212	(0.0922)	12.0922	-2.8534%	-0.4709%	0.0434%
8	0.00	-0.0421	22.00	0.0389	(0.1691)	22.1691	-0.4363%	-0.0720%	0.0122%
9	0.00	-0.0421	24.00	0.0425	(0.1844)	24.1844	1.6895%	0.2789%	-0.0514%
10	-1.00	-1.0421	23.75	25.7904	(4.5209)	28.2709	1.4884%	0.2457%	-1.1106%
J	-1.00	-1.0421	23.75	25.7904	(4.5209)	28.2709	1.4884%	0.2457%	-1.1106%
Q	-1.00	-1.0421	23.75	25.7904	(4.5209)	28.2709	1.4884%	0.2457%	-1.1106%
K	-1.00	-1.0421	23.75	25.7904	(4.5209)	28.2709	1.4884%	0.2457%	-1.1106%
A	-1.00	-1.0421	24.00	26.0619	(4.5684)	28.5684	-1.5722%	-0.2595%	1.1854%
Total (a)	13.00	0.0000	309.00	250.4531	-	309.0000	-0.6159%	-0.1016%	-6.1695%
mu = mean (b)	0.0421	0.0000							

(a) Tot(col (A)) = Sumproduct(Col (A), Col (3)) where A = (1), (2), (7), (8)

Totals of columns (3), (4), (5), (6) and (9) totals are straight column sums.

(b) Mean(col (A)) = Tot(Col (A)) / Tot(Col (3)) where A = (1), (2)

(c) [Estimated # cards of denomination "c" removed when true count = (tc')]

= (frequency of card denomination, "c") * [(tc') * (x) / Var(x)]

note: dim { (tc') } = dim (rc/cr) = dim (x)

since "rc" is the running count of the balanced count "x",

so dim { (tc') * (x) / Var(x)] } = dimensionless.

= F(c) * [(tc') * (x) * / { Sum (F*x^2) / (cr) }] since mean(x) = 0

note: cr = cards remaining = (52* k - n) where n = number of cards removed.

= F(c) * [(tc') * (x) * (cr) / Sum (F*x^2)] where (cr) = (52*k - n)

= col (3) * [(tc') * col (2) * (cr) / Tot (4)] where (cr) = (52*k - n)

	card removed	
EoR(puc1, single deck)	8	-0.4363%
EoR(puc2, single deck)	8	-0.4363%
EoR(duc, single deck)	T	1.4884%
Sum { EoR(puc1, puc2, duc) }	n/a	0.6159%
Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]		0.1016%
Total EoR removed cards		-6.0679%
FDHA, k decks (Exhibit 5)		-6.0679%
FDHA - Tot EoR removed cards	**House EV**	**0.0000%**
See Calculation of Index before Application of Modified Tag	tc =	7.6795
T = Sum(Tags Removed: col(1))		-1.0000
MT = Modified Tagged value = T * [52 / (52*k - n)]		-0.1683
Index (Idx) = tc + MT		***7.5112***

Finite Deck Calculation of Indices

Proportional Deflection

Calculation of Unmodified True Count corresponding to Expected Value = 0

k = # of decks	tc =	1.0000
6	tc' = (tc/52) =	0.0192

Choose "tc = 1.0000" and get total "tc = 1" EoR = Tot (9) for tc = 1.0000.

Card	(1) **X** Red 7 Count	(2) **x=** X - uX *Balanced Count*	(3) F = freq k decks # of cards	(4) SS(x) = Sum Squares F*x^2	(5) "tc" Estimated # of cards removed (c)	(6) = (3) - (5) "tc" Est. # of cards remaining	(7) **Y** Effect of Removal (EoR)	(8) EoR(k,n) = 51 / (52*k - n) * EoR	(9) =(5) * (8) "tc = t" EoR removed cards
2	1.00	0.9579	24.00	22.0231	0.5455	23.4545	-1.5572%	-0.2570%	-0.1402%
3	1.00	0.9579	24.00	22.0231	0.5455	23.4545	-2.2962%	-0.3790%	-0.2067%
4	1.00	0.9579	24.00	22.0231	0.5455	23.4545	0.4338%	0.0716%	0.0391%
5	1.00	0.9579	24.00	22.0231	0.5455	23.4545	0.4131%	0.0682%	0.0372%
6	1.00	0.9579	24.00	22.0231	0.5455	23.4545	0.2250%	0.0371%	0.0203%
Red 7	1.00	0.9579	12.00	11.0115	0.2727	11.7273	-2.8534%	-0.4709%	-0.1284%
Black 7	0.00	-0.0421	12.00	0.0212	(0.0120)	12.0120	-2.8534%	-0.4709%	0.0056%
8	0.00	-0.0421	22.00	0.0389	(0.0220)	22.0220	-0.4363%	-0.0720%	0.0016%
9	0.00	-0.0421	24.00	0.0425	(0.0240)	24.0240	1.6895%	0.2789%	-0.0067%
10	-1.00	-1.0421	23.75	25.7904	(0.5872)	24.3372	1.4884%	0.2457%	-0.1443%
J	-1.00	-1.0421	23.75	25.7904	(0.5872)	24.3372	1.4884%	0.2457%	-0.1443%
Q	-1.00	-1.0421	23.75	25.7904	(0.5872)	24.3372	1.4884%	0.2457%	-0.1443%
K	-1.00	-1.0421	23.75	25.7904	(0.5872)	24.3372	1.4884%	0.2457%	-0.1443%
A	-1.00	-1.0421	24.00	26.0619	(0.5934)	24.5934	-1.5722%	-0.2595%	0.1540%
Total (a)	13.00	0.0000	309.00	250.4531	-	309.0000	-0.6159%	-0.1016%	-0.8013%
mu = mean (b)	0.0421	0.0000							

Tot (9) = { EoR:PD @ tc = +1 } = AACpTCp from Exhibit I2

Find "tc = t" so House Expected Value (EV) is zero:

tc	=	1.0000	AACpTCp	Exhibit I2
Tot (9)	=	-0.8013%	-0.8013%	Exhibit I2

t *	-0.8013%
+	0.1016%
=	-6.0679%

t =True Count Index before modification

t = 7.6989

	card removed	
EoR(puc1, single deck)	8	-0.4363%
EoR(puc2, single deck)	8	-0.4363%
EoR(duc, single deck)	T	1.4884%
Sum { EoR(puc1, puc2, duc) }	n/a	0.6159%
Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]		0.1016%
Total EoR removed cards		-0.6997%
FDHA, k decks (Exhibit 5)		-6.0679%
FDHA - Tot EoR removed cards	**House EV**	**-5.3682%**

Note:

Let EoR:(n,k) = EoR from "n" cards removed from "k" decks = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]

Then above equation says: t * (AACpTCp) + EoR:(n,k) = FDHA

From LSL definition in Exhibit 2: MDHA = Modified Deck House Advantage = FDHA - EoR:(n,k)

so t = (FDHA - EoR:(n,k)) / AACpTCp = MDHA / AACpTCp which is the first term of the Idx calculation from LSL procedure, Exhibit 2.

Finite Deck Calculation of Indices

Proportional Deflection

Calculation of Index Before Application of Modified Tag Value

k = # of decks
6

tc =	7.6989
tc' = (tc/52) =	0.1481

Calculated BALANCED "tc" (Col (2))
giving Expected Value = 0 as shown above.

Card	(1) **X** Red 7 Count	(2) **x=** X - uX *Balanced Count*	(3) One Full Deck	Full Deck Ending Count Red 7 (1a) = (1)*(3)	Full Deck Ending Count *Balanced Count* (2a) = (2)*(3)	(5) "tc" Estimated # of cards removed (c)	***Running Counts*** (1b) = (1)*(5) Red 7	***Running Counts*** (2b) = (2)*(5) *Balanced Count*
2	1.00	0.9579	4.0000	4.0000	3.8317	4.1996	4.1996	4.0229
3	1.00	0.9579	4.0000	4.0000	3.8317	4.1996	4.1996	4.0229
4	1.00	0.9579	4.0000	4.0000	3.8317	4.1996	4.1996	4.0229
5	1.00	0.9579	4.0000	4.0000	3.8317	4.1996	4.1996	4.0229
6	1.00	0.9579	4.0000	4.0000	3.8317	4.1996	4.1996	4.0229
Red 7	1.00	0.9579	2.0000	2.0000	1.9159	2.0998	2.0998	2.0114
Black 7	0.00	-0.0421	2.0000	0.0000	-0.0841	(0.0922)	0.0000	0.0039
8	0.00	-0.0421	4.0000	0.0000	-0.1683	(0.1691)	0.0000	0.0071
9	0.00	-0.0421	4.0000	0.0000	-0.1683	(0.1844)	0.0000	0.0078
10	-1.00	-1.0421	4.0000	-4.0000	-4.1683	(4.5209)	4.5209	4.7111
J	-1.00	-1.0421	4.0000	-4.0000	-4.1683	(4.5209)	4.5209	4.7111
Q	-1.00	-1.0421	4.0000	-4.0000	-4.1683	(4.5209)	4.5209	4.7111
K	-1.00	-1.0421	4.0000	-4.0000	-4.1683	(4.5209)	4.5209	4.7111
A	-1.00	-1.0421	4.0000	-4.0000	-4.1683	(4.5684)	4.5684	4.7606
Total	n/a	n/a	52.0000	**2.0000**	**-0.1877**	-	**45.7495**	**45.7495**
Unbalance per Deck = u						u =	2.0000	-0.1877
Number or Decks = n						n =	6.0000	6.0000
Total Unbalance for "n" decks = Unbalance Per Deck * Number of Decks = u * n						u*n =	12.0000	-1.1262
Critical True Count Before Application of Modified Tag Value = u + { rc - u*n } / dr							**7.6795**	7.7008

Red 7 rc = running count, n = number of decks, dr = decks remaining

Unbalance Per Deck	2.0000	Cards Remaining	309.00
Number or Decks, n	6	Decks Remaining	5.9423

True Count ***2.0000*** ***+*** ***(rc -*** ***2.0000*** **** n) / dr***

<u>Generalized True Count</u>
*True Count = (unbalanced count per deck) + { (running count) - (unbalanced count per deck) * (# of decks) } / (decks remaining)*
If tc = true count, rc = running count, u = unbalanced count per deck, n = number of decks, dr = decks remaining, dp = decks played then:
tc = u + (rc - u*n) / dr = (rc - u*dp) / dr

<u>Notes:</u>
(1) tc = u + (rc - u*n) / dr. n = # decks = (dp + dr) and so tc = (rc - u*dp)/dr.
Note that u*dp = expected unbalance when "dp" decks are played so (rc - u*dp) = expected equivalent balanced running count.
(2) For Red 7, u = 2.00, so tc = 2 + (rc - 2*n) / dr (3) For Hi-Low, u = 0, so tc = rc / dr
(4) For KO (counts all 7's as +1, not just the Red 7's), u = 4.00, so tc = 4 + (rc - 4*n) / dr

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

Cubic Interpolation by Reciprocals
Y = A3*X^3 + A2*X^2 + A1*X + A0
Note: Since X = (1/k) = (k)^(-1), where k = # decks, then Y = A3*(k^(-3)) + A2*(k^(-2)) + A1*(k^(-1)) + A0 = A3*(1/k^3) + A2*(1/k^2) + A1*(1/k) + A0

crn	Count Reference #	1
srn	Situation Reference #	52
k_decks	k = number of decks	6
	Count	Red 7
	Situation	8,8 v T DAS: split-std (derived)

,8 v T DAS: split-std (derivec	
k	FDHA(k)
1	-6.5136%
2	-6.2559%
6	-6.0679%
8	-6.0435%

Y =	0.00082%	* X^3	+	0.05695%	* X^2	+	-0.60226%	* X	+	-5.96911%

Decks **6**
Situation 8,8 v T DAS: split-std (derived)

			FDHA(k)		
k decks	situation	X = (1/k)	Y cubic	Y linear *	Y linear - cubic
6	8,8 v T DAS: s	0.16667	-6.0679%	-6.0659%	0.0020%
infinite	8,8 v T DAS: s	0	-5.9691%	-5.9763%	-0.0072%

* Y linear: see Exhibit L1:
FDHA(k) = FDHA(1) * { (1/7) * (8/k - 1) } + FDHA(8) * { (8/7) * (1 - (1/k)) }
= FDHA(1) * { (1/7) * (8*X - 1) } + FDHA(8) * { (8/7) * (1 - X)) }, X = (1/k)

8,8 v T DAS: split-std (derived)
FDHA = Full Deck House Advantage
Cubic Interpolation by Reciprocals

k	X = (1/k)	FDHA(k) from BJA3	FDHA(k) Y cubic	Difference BJA3 - Y cubic	FDHA(k) Y linear *	Difference Y linear - cubic
1	1.0000	-6.5136%	-6.5136%	0.0000%	-6.5136%	0.0000%
2	0.5000	-6.2559%	-6.2559%	0.0000%	-6.2450%	0.0109%
3	0.3333	n/a	-6.1635%	n/a	-6.1554%	0.0081%
4	0.2500	n/a	-6.1161%	n/a	-6.1107%	0.0054%
5	0.2000	n/a	-6.0873%	n/a	-6.0838%	0.0035%
6	0.1667	-6.0679%	-6.0679%	0.0000%	-6.0659%	0.0020%
7	0.1429	n/a	-6.0540%	n/a	-6.0531%	0.0009%
8	0.1250	-6.0435%	-6.0435%	0.0000%	-6.0435%	0.0000%
1000	0.0010	n/a	-5.9697%	n/a	-5.9769%	-0.0072%
infinite	0.0000	n/a	-5.9691%	n/a	-5.9763%	-0.0072%

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

8,8 v T DAS: split-std (derived)

k	X = (1/k)	X^2	X^3	FDHA(k) from BJA3 Y
1	1.0000	1.0000	1.0000	-6.5136%
2	0.5000	0.2500	0.1250	-6.2559%
6	0.1667	0.0278	0.0046	-6.0679%
8	0.1250	0.0156	0.0020	-6.0435%

A3	*****	**X^3**	**+**	**A2**	*****	**X^2**	**+**	**A1**	*****	**X**	**+**	**A0**	**=**	**Y**
A3	*	1.0000	+	A2	*	1.0000	+	A1	*	1.0000	+	A0	=	-6.5136%
A3	*	0.1250	+	A2	*	0.2500	+	A1	*	0.5000	+	A0	=	-6.2559%
A3	*	0.0046	+	A2	*	0.0278	+	A1	*	0.1667	+	A0	=	-6.0679%
A3	*	0.0020	+	A2	*	0.0156	+	A1	*	0.1250	+	A0	=	-6.0435%

Four Linear Equations, Four Unknowns

Cramer's Rule

1.0000	**1.0000**	**1.0000**	**1.0000**	**-6.5136%**	**A3**	**=**	**0.00082%**
0.1250	**0.2500**	**0.5000**	**1.0000**	**-6.2559%**	**A2**	**=**	**0.05695%**
0.0046	**0.0278**	**0.1667**	**1.0000**	**-6.0679%**	**A1**	**=**	**-0.60226%**
0.0020	**0.0156**	**0.1250**	**1.0000**	**-6.0435%**	**A0**	**=**	**-5.96911%**

A3	=	D:A3 / D	=	0.000000016	/	0.001898872
A3	=	0.0000082				
A2	=	D:A2 / D	=	0.000001081	/	0.001898872
A2	=	0.0005695				
A1	=	D:A1 / D	=	-0.000011436	/	0.001898872
A1	=	-0.0060226				
A0	=	D:A0 / D	=	-0.000113346	/	0.001898872
A0	=	-0.0596911				

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	1.0000000	1.0000000		
D	**=**	0.1250000	0.2500000	0.5000000	1.0000000	=	0.001898872
		0.0046296	0.0277778	0.1666667	1.0000000		
		0.0019531	0.0156250	0.1250000	1.0000000		

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.04166667	+	0.00781250	+	0.00347222		
		-	0.00260417	-	0.03125000	-	0.01388889		
1.0000000	*		0.00520833					=	0.005208333
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.16666667	+	0.01562500	+	0.00347222		
		-	0.00260417	-	0.12500000	-	0.02777778		
-0.1250000	*		0.03038194					=	-0.003797743
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.50000000	+	0.01562500	+	0.03125000		
		-	0.00781250	-	0.12500000	-	0.25000000		
0.0046296	*		0.16406250					=	0.000759549
		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000			
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000			
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667			
		+	0.50000000	+	0.02777778	+	0.04166667		
		-	0.01388889	-	0.16666667	-	0.25000000		
-0.0019531	*		0.13888889					=	-0.000271267
							D	**=**	0.001898872

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		-0.0651360	1.0000000	1.0000000	1.0000000		
D:A3	**=**	-0.0625590	0.2500000	0.5000000	1.0000000	=	0.000000016
		-0.0606790	0.0277778	0.1666667	1.0000000		
		-0.0604350	0.0156250	0.1250000	1.0000000		

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.04166667	+	0.00781250	+	0.00347222		
		-	0.00260417	-	0.03125000	-	0.01388889		
-0.0651360	*		0.00520833					=	-0.000339250

		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.16666667	+	0.01562500	+	0.00347222		
		-	0.00260417	-	0.12500000	-	0.02777778		
0.0625590	*		0.03038194					=	0.001900664

		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.50000000	+	0.01562500	+	0.03125000		
		-	0.00781250	-	0.12500000	-	0.25000000		
-0.0606790	*		0.16406250					=	-0.009955148

		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000			
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000			
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667			
		+	0.50000000	+	0.02777778	+	0.04166667		
		-	0.01388889	-	0.16666667	-	0.25000000		
0.0604350	*		0.13888889					=	0.008393750
							D:A3	**=**	0.000000016

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	*-0.0651360*	1.0000000	1.0000000		
D:A2	=	0.1250000	*-0.0625590*	0.5000000	1.0000000	=	0.000001081
		0.0046296	*-0.0606790*	0.1666667	1.0000000		
		0.0019531	*-0.0604350*	0.1250000	1.0000000		

		-0.06255900	0.50000000	1.00000000	-0.06255900	0.50000000		
		-0.06067900	0.16666667	1.00000000	-0.06067900	0.16666667		
		-0.06043500	0.12500000	1.00000000	-0.06043500	0.12500000		
		+	-0.01042650	+	-0.03021750	+	-0.00758488	
		-	-0.01007250	-	-0.00781988	-	-0.03033950	
1.0000000	*		0.00000300				=	0.000003000
		-0.06513600	1.00000000	1.00000000	-0.06513600	1.00000000		
		-0.06067900	0.16666667	1.00000000	-0.06067900	0.16666667		
		-0.06043500	0.12500000	1.00000000	-0.06043500	0.12500000		
		+	-0.01085600	+	-0.06043500	+	-0.00758488	
		-	-0.01007250	-	-0.00814200	-	-0.06067900	
-0.1250000	*		0.00001762				=	-0.000002203
		-0.06513600	1.00000000	1.00000000	-0.06513600	1.00000000		
		-0.06255900	0.50000000	1.00000000	-0.06255900	0.50000000		
		-0.06043500	0.12500000	1.00000000	-0.06043500	0.12500000		
		+	-0.03256800	+	-0.06043500	+	-0.00781988	
		-	-0.03021750	-	-0.00814200	-	-0.06255900	
0.0046296	*		0.00009562				=	0.000000443
		-0.0651360	1.0000000	1.0000000	-0.06513600	1.00000000		
		-0.0625590	0.5000000	1.0000000	-0.06255900	0.50000000		
		-0.0606790	0.1666667	1.0000000	-0.06067900	0.16666667		
		+	-0.03256800	+	-0.06067900	+	-0.01042650	
		-	-0.03033950	-	-0.01085600	-	-0.06255900	
-0.0019531	*		0.00008100				=	-0.000000158
							D:A2 **=**	0.000001081

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	*-0.0651360*	1.0000000					
D:A1	**=**	0.1250000	0.2500000	*-0.0625590*	1.0000000	=	-0.000011436			
		0.0046296	0.0277778	*-0.0606790*	1.0000000					
		0.0019531	0.0156250	*-0.0604350*	1.0000000					
			0.25000000	-0.06255900	1.00000000	0.25000000	-0.06255900			
			0.02777778	-0.06067900	1.00000000	0.02777778	-0.06067900			
			0.01562500	-0.06043500	1.00000000	0.01562500	-0.06043500			
			+	-0.01516975	+	-0.00097748	+	-0.00167875		
			-	-0.00094811	-	-0.01510875	-	-0.00173775		
1.0000000	*			-0.00003138					=	-0.000031375
			1.00000000	-0.06513600	1.00000000	1.00000000	-0.06513600			
			0.02777778	-0.06067900	1.00000000	0.02777778	-0.06067900			
			0.01562500	-0.06043500	1.00000000	0.01562500	-0.06043500			
			+	-0.06067900	+	-0.00101775	+	-0.00167875		
			-	-0.00094811	-	-0.06043500	-	-0.00180933		
-0.1250000	*			-0.00018306					=	0.000022882
			1.00000000	-0.06513600	1.00000000	1.00000000	-0.06513600			
			0.25000000	-0.06255900	1.00000000	0.25000000	-0.06255900			
			0.01562500	-0.06043500	1.00000000	0.01562500	-0.06043500			
			+	-0.06255900	+	-0.00101775	+	-0.01510875		
			-	-0.00097748	-	-0.06043500	-	-0.01628400		
0.0046296	*			-0.00098902					=	-0.000004579
			1.0000000	-0.0651360	1.0000000	1.00000000	-0.06513600			
			0.2500000	-0.0625590	1.0000000	0.25000000	-0.06255900			
			0.0277778	-0.0606790	1.0000000	0.02777778	-0.06067900			
			+	-0.06255900	+	-0.00180933	+	-0.01516975		
			-	-0.00173775	-	-0.06067900	-	-0.01628400		
-0.0019531	*			-0.00083733					=	0.000001635
								D:A1	**=**	-0.000011436

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	1.0000000	*-0.0651360*		
D:A0	**=**	0.1250000	0.2500000	0.5000000	*-0.0625590*	=	-0.000113346
		0.0046296	0.0277778	0.1666667	*-0.0606790*		
		0.0019531	0.0156250	0.1250000	*-0.0604350*		

		0.25000000	0.50000000	-0.06255900	0.25000000	0.50000000			
		0.02777778	0.16666667	-0.06067900	0.02777778	0.16666667			
		0.01562500	0.12500000	-0.06043500	0.01562500	0.12500000			
		+	-0.00251813	+	-0.00047405	+	-0.00021722		
		-	-0.00016291	-	-0.00189622	-	-0.00083938		
1.0000000	*		-0.00031089					=	-0.000310891
		1.00000000	1.00000000	-0.06513600	1.00000000	1.00000000			
		0.02777778	0.16666667	-0.06067900	0.02777778	0.16666667			
		0.01562500	0.12500000	-0.06043500	0.01562500	0.12500000			
		+	-0.01007250	+	-0.00094811	+	-0.00022617		
		-	-0.00016963	-	-0.00758488	-	-0.00167875		
-0.1250000	*		-0.00181353					=	0.000226691
		1.00000000	1.00000000	-0.06513600	1.00000000	1.00000000			
		0.25000000	0.50000000	-0.06255900	0.25000000	0.50000000			
		0.01562500	0.12500000	-0.06043500	0.01562500	0.12500000			
		+	-0.03021750	+	-0.00097748	+	-0.00203550		
		-	-0.00050888	-	-0.00781988	-	-0.01510875		
0.0046296	*		-0.00979298					=	-0.000045338
		1.0000000	1.0000000	-0.0651360	1.00000000	1.00000000			
		0.2500000	0.5000000	-0.0625590	0.25000000	0.50000000			
		0.0277778	0.1666667	-0.0606790	0.02777778	0.16666667			
		+	-0.03033950	+	-0.00173775	+	-0.00271400		
		-	-0.00090467	-	-0.01042650	-	-0.01516975		
-0.0019531	*		-0.00829033					=	0.000016192
							D:A0	**=**	-0.000113346

Insurance Indices and Correlation Coefficient
for Hi-Low and Red 7 counts

Hi-Low

k, # decks	1	2	6	8	Infinite
Corr Coef	78.85%	77.41%	76.47%	76.36%	76.01%
Index	1.42	2.38	3.01	3.09	3.33

Red 7

k, # decks	1	2	6	8	Infinite
Corr Coef	80.02%	78.53%	77.57%	77.46%	77.10%
Index	1.40	2.38	3.04	3.12	3.36

Notes

Exhibit J2 shows Insurance Least Squares Line calculations for Six Deck Red 7 count.
Exhibit J3 shows Insurance Least Squares Line calculations for Infinite Deck Red 7 count.
Exhibit J4 shows Insurance Proportional Deflection calculations for Six Deck Red 7 count.

Count **Hi-Low** Situation ***Insurance***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	78.85%	Cor Coef	77.41%	Cor Coef	76.47%	Cor Coef	76.36%	Cor Coef	76.01%
AACpTCp	2.414%	AACpTCp	2.360%	AACpTCp	2.325%	AACpTCp	2.321%	AACpTCp	2.308%
FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA, infinite	7.692%
MDHA,"k" dks	5.882%	MDHA,"k" dks	6.796%	MDHA,"k" dks	7.395%	MDHA,"k" dks	7.470%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	0.000	YI, "k" decks	0.000	YI, "k" decks	0.000	YI, "k" decks	0.000	YI = 0	n/a
Prop Defl Idx	**1.42**	Prop Defl Idx	**2.37**	Prop Defl Idx	**3.01**	Prop Defl Idx	**3.09**	Index, Idx	**3.33**

(Exhibit K6) — *pa(t) = AACpTCp * (t - Idx)* (for k = 1, 2, 6, 8)

*pa(t) = AACpTCp * (t - Idx)*
*= AACpTCp * t - FDHA* (for k = infinite)

Red 7 t	Insurance pa(t), k = 1	Insurance pa(t), k = 2	Insurance pa(t), k = 6	Insurance pa(t), k = 8	Insurance pa(t), k = infinite
0	-3.42%	-5.60%	-7.01%	-7.18%	-7.69%
1	-1.01%	-3.24%	-4.68%	-4.86%	-5.38%
2	1.41%	-0.88%	-2.36%	-2.54%	-3.08%
3	3.82%	1.47%	-0.03%	-0.22%	-0.77%
4	6.24%	3.83%	2.29%	2.10%	1.54%
5	8.65%	6.19%	4.62%	4.42%	3.85%
6	11.07%	8.55%	6.94%	6.74%	6.15%
7	13.48%	10.91%	9.27%	9.06%	8.46%

Insurance Indices and Correlation Coefficient
for Hi-Low and Red 7 counts

Count **Red 7** Situation ***Insurance***

k (# decks) =	1	k (# decks) =	2	k (# decks) =	6	k (# decks) =	8	k (# decks) =	infinite
Cor Coef	80.02%	Cor Coef	78.53%	Cor Coef	77.57%	Cor Coef	77.46%	Cor Coef	77.10%
AACpTCp	2.394%	AACpTCp	2.339%	AACpTCp	2.304%	AACpTCp	2.299%	AACpTCp	2.287%
FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA,"k" dks	7.692%	FDHA, infinite	7.692%
MDHA,"k" dks	5.882%	MDHA,"k" dks	6.796%	MDHA,"k" dks	7.395%	MDHA,"k" dks	7.470%	MDHA=FDHA	n/a
MT, "k" dks	(1.020)	MT, "k" dks	(0.505)	MT, "k" dks	(0.167)	MT, "k" dks	(0.125)	MT = 0	n/a
YI, "k" decks	(0.039)	YI, "k" decks	(0.019)	YI, "k" decks	(0.006)	YI, "k" decks	(0.005)	YI = 0	n/a
Prop Defl Idx	**1.40**	Prop Defl Idx	**2.38**	Prop Defl Idx	**3.04**	Prop Defl Idx	**3.12**	Index, Idx	**3.36**

(Exhibit K6)

pa(t) = AACpTCp * (t - Idx)

k (# decks) =	1
Red 7	Insurance
t	pa(t)
0	-3.35%
1	-0.95%
2	1.44%
3	3.84%
4	6.23%
5	8.62%
6	11.02%
7	13.41%

(Exhibit K6)

pa(t) = AACpTCp * (t - Idx)

k (# decks) =	2
Red 7	Insurance
t	pa(t)
0	-5.57%
1	-3.23%
2	-0.89%
3	1.45%
4	3.79%
5	6.13%
6	8.46%
7	10.80%

(Exhibit K6)

pa(t) = AACpTCp * (t - Idx)

k (# decks) =	6
Red 7	Insurance
t	pa(t)
0	-7.00%
1	-4.69%
2	-2.39%
3	-0.08%
4	2.22%
5	4.52%
6	6.83%
7	9.13%

(Exhibit K6)

pa(t) = AACpTCp * (t - Idx)

k (# decks) =	8
Red 7	Insurance
t	pa(t)
0	-7.17%
1	-4.87%
2	-2.57%
3	-0.27%
4	2.03%
5	4.33%
6	6.63%
7	8.93%

pa(t) = AACpTCp * (t - Idx)

= AACpTCp * t - FDHA

k (# decks) =	infinite
Red 7	Insurance
t	pa(t)
0	-7.69%
1	-5.41%
2	-3.12%
3	-0.83%
4	1.45%
5	3.74%
6	6.03%
7	8.31%

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Count	Red 7	k = # of Decks, k_decks	6	Player's Up Card #2, puc2	n/a
Situation	Insurance	Player's Up Card #1, puc1	n/a	Dealer's Up Card, duc	A

Card	(1) X Red 7 Count	(2) x= X - uX	(3) Y (a) Effect of Removal	(4) y = Y - uY	(5) F = freq "k" deck # of cards	(6) = (5)*(2)*(4) F*x*y	(7) = (5)*(2)^2 F*x^2	(8) = (5)*(4)^2 F*y^2
2	1.00	0.9582	1.8100%	1.8158%	24.00	41.7570%	22.0355	0.7913%
3	1.00	0.9582	1.8100%	1.8158%	24.00	41.7570%	22.0355	0.7913%
4	1.00	0.9582	1.8100%	1.8158%	24.00	41.7570%	22.0355	0.7913%
5	1.00	0.9582	1.8100%	1.8158%	24.00	41.7570%	22.0355	0.7913%
6	1.00	0.9582	1.8100%	1.8158%	24.00	41.7570%	22.0355	0.7913%
Red 7	1.00	0.9582	1.8100%	1.8158%	12.00	20.8785%	11.0178	0.3956%
Black 7	0.00	-0.0418	1.8100%	1.8158%	12.00	-0.9108%	0.0210	0.3956%
8	0.00	-0.0418	1.8100%	1.8158%	24.00	-1.8216%	0.0419	0.7913%
9	0.00	-0.0418	1.8100%	1.8158%	24.00	-1.8216%	0.0419	0.7913%
10	-1.00	-1.0418	-4.0724%	-4.0666%	24.00	101.6775%	26.0484	3.9689%
J	-1.00	-1.0418	-4.0724%	-4.0666%	24.00	101.6775%	26.0484	3.9689%
Q	-1.00	-1.0418	-4.0724%	-4.0666%	24.00	101.6775%	26.0484	3.9689%
K	-1.00	-1.0418	-4.0724%	-4.0666%	24.00	101.6775%	26.0484	3.9689%
A	-1.00	-1.0418	1.8100%	1.8158%	23.00	-43.5085%	24.9630	0.7583%
Total (b)	13.00	0.0000	-1.8100%	0.0000%	311.00	588.3110%	250.4566	22.9642%
mu = mean (c)	0.0418	0.0000	-0.0058%	0.0000%				

(a) Y = single deck EoR. If no cards are removed then "Y" does not have to be adjusted for various number of decks for
Correlation Coefficient calculation since if "Y" is multiplied by any constant, that constant will cancel out when CC is calculated.
(but if cards are removed then CC will vary by decks per Frequency of cards, col (5)). CC = Sum(F*x*y) / SQRT [Sum(F*x^2) * Sum(F*y^2)]
(b) Tot(col (A)) = Sumproduct(Col (A), Col (5)) where A = (1), (2), (3) or (4).
(c) Mean(col (A)) = Tot(Col (A)) / Tot(Col (5)) where A = (1), (2), (3) or (4).

Corr Coef = Sum(F*x*y) / SQRT [Sum(F*x^2) * Sum(F*y^2)] = Tot (6) / SQRT [Tot (7) * Tot (8)] {note: CC is dimensionless}	77.57%
m = slope = Sum(F*x*y) / Sum (F*x^2) = Tot (6) / Tot (7) {note: dim [slope] = dim (x*y) / dim(x^2) = dim(y) / dim(x) = rise / run}	2.349%

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

m = Slope of generalized Least Square Line (LSL), Y = mX + b, Y = EoR and X = count tag values

One deck EoR, "y", weighted with "x" tag values and "k" deck card distribution of remaining cards

Definitions of Slope and EoR:

Slope = Change (EoR) / Change (Tag Value) = Change(EoR) per unit change in the tag values for the given count.

EoR(c) = EV(51 cards remaining after removal of card "c") - EV(52 cards), EV(52 cards) = constant for given situation. (See Exhibit 5).

Change(EoR) = EV(51 cards, tag value = (tv+1)) - EV(51 cards, tag value = tv) = slope of LSL through EoR and Tag Values.

So EoR and therefore the slope "m" are based on 51 cards and the slope is the average change in EoR per unit Tag Value

if AAC = average advantage change, then m = slope of LSL = (AAC / 51 cards) and AACpTCp = AAC / deck = AAC / 52 cards

So AACpTCp = (AAC / deck) = (AAC / 52 cards) = (AAC / 51 cards) * (51 cards / 52 cards) = m * (51/ 52)

b = "k" deck LSL Y-intercept, b = uY - m*u X (not used in Index calculation) -0.1040%			
k = number of decks = k_decks	6		
n = number of cards removed = n_out	1		
AACpTCp = m * [(51) / (52)]		*card removed*	2.304%
EoR(puc1, single deck): (if positive: increases player advantage = decreases house advantage)		n/a	0.000% *(a1)*
EoR(puc2, single deck): (if positive: increases player advantage = decreases house advantage)		n/a	0.000% *(a2)*
EoR(duc, single deck): (if positive: increases player advantage = decreases house advantage)		A	1.810% *(a3)*
EoR(n cards removed, k decks) = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)] (See Exhibit 5)			0.297%
FDHA = Full Deck House Advantage for "k" decks (See Exhibit 5)			7.692%
MDHA = Modified Deck House Advantage = FDHA - EoR(n cards removed, k decks)			7.395%
T = Sum { Tagged value of removed cards: (puc1, puc2, duc) }			-1.000
MT = Modified Tagged value = T * [52 / (52*k - n)], k = # decks, n = # of cards removed			-0.167

MT = Sum (Tag Values of Cards Removed) / (Decks Remaining) = [Sum (Tags Removed) / Cards Remaining] * [52 cards / deck]

= [Sum (Tags Removed) / (52*k - n)] * [52 cards / deck] = Sum (Tags Removed) * [52 / (52*k - n)]

If dr = decks remaining and cr = cards remaining then cr = 52*dr and dr = (cr/52). Also cr = (52*k - n) so

MT = Sum(Tags Removed) / dr = Sum(Tags Removed) / (cr/52) = 52 * Sum(Tags Removed) / cr

= 52 * Sum(Tags Removed) / (52*k - n) = [52 / (52*k - n)] * Sum(Tags Removed)

Idx = Index = { MDHA / AACpTCp } + MT *3.0430*

Notes:

(a1) =IF(puc1="n/a",0,VLOOKUP(srn,EoR,MATCH(duc,EoR_header,0))/100). (a2) and (a3) calculated similarly.

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Adjustment to Index

Method 1

This adjustment is zero for balanced counts (b:inf = 0), no cards removed (n = 0), or infinite number of decks (k = infinity):

Let YI = infinite deck Y-Intercept adjustment

b:inf = infinite deck LSL Y-intercept (See Exhibit 3)	-0.0897%	
AACpTCp:inf = infinite deck AACpTCp (See Exhibit 3)	2.2865%	
k = number of decks = k_decks	6	
n = number of cards removed = n_out = cp = cards played	1	
YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }		-0.0064 *(b)*

Method 2

This adjustment is zero for balanced counts (u = 0), no cards removed (n = 0), or infinite number of decks (k = infinity)

uX:full deck = mean(X)= Sum(X) / # cards (Exhibit 3, Col (1), mean)	0.03846	*Red 7*
Unbalance per Deck = u = uX * 52 cards	2.00	(also see Exhibit 4, last page, column (1a), Tot)
k = number of decks = k_decks	6	
n = number of cards removed = n_out = cp = cards played	1	
YI = (-1) * ((u * dp) / dr) = (-1) * ((u * cp) / cr) = (-1) * u * { n / (52*k - n) }		-0.0064 *(c)*
Idx = Index = { MDHA / AACpTCp } + MT + YI		***3.0365***

(b) **YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }**

b:inf = infinite deck change in expectation per 51 cards since b:inf is part of infinite deck LSL equation: Y = m*X + b where Y = EoR

b:inf * [51 / (52*k - n) = change in expectation per card for k decks and n cards removed (cards remaining = 52*k - n)

b:inf * [51 / (52*k - n) / AACpTCp:inf = change in true count per card removed (dimensions: (expectation / card) / (expectation / true count) = true count / card

YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = true count adjustment when "n" cards removed.

(c) **YI = (-1) * ((u * dp) / dr) = (-1) * ((u * cp) / cr) = (-1) * u * { n / (52*k - n) }**

where u = unbalance per deck, cp = cards played = n = n_out, cr = cards remaining, dp = decks played = 52*cp, dr = decks remaining = 52*cr

u*dp = unbalance in running count when "dp" decks played, u*dp / dr = unbalance in true count when "dp" decks played

T = Sum { Tagged value of removed cards: (puc1, puc2, duc) } shown above. If count is unbalanced, then T must be modified to what an equivalent balanced count tagged values removed would be. This would be then T - u*(dp). This running count tag adjustment must then be adjusted to a true count basis so the total tag adjustment would be (T - u*(dp)) / dr = (T/dr) - (u*(dp) / dr) = MT + YI

Index = (MDHA /AACpTCp) + MT + YI = (MDHA/AACpTCp) + (T - u*dp)/dr

where MDHA = FHDA - EoR(cp,k), cp = cards played, k = number of decks

AACpTCp = {(Slope of LSL(EoR,X)}*(51/52) where X = tag values of count

and MT + YI = (T - u*(dp)) / dr = total true count Index adjustment for tags removed

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

*Prove YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = (-1) * u * { n / (52*k - n) }*

b:inf = uY - m*u X = infinite deck LSL Y- intercept:

uY = mean Y where Y = EoR, since Sum(Y) = 0 then uY = 0

uX = mean (X) = (Sum(X) / card) and u = Unbalance per Deck = uX * 52

so b:inf = uY - m*uX = 0 - m * (u/52) = (-1) * m * (u/52)

AACpTCp:inf = m * (51/52)

YI = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf }

YI = n * { (-1) * m * (u/52) } * [51 / (52*k - n)] / { m * (51/52) }

YI = (-1) * u * { n / (52*k - n) } where n = cards out and (52*k - n) = cards remaining and u = unbalance per deck

*Prove true count corresponding to a running count of "T" and "dp" decks played is (T - u*dp)/dr = MT + YI*

dp = decks played, dr = decks remaining, n = number of decks, u = unbalance per deck, tc = true count, rc = running count = tags removed (T),

T = Sum { Tagged value of removed cards: (puc1, puc2, duc) } = running count which needs to be converted to a true count and added to Index.

tc = u + (rc - u*n)/dr where n = number of decks = dp + dr and rc = T then the corresponding tc = u + (T - u*(dp + dr))/dr = (T - u*dp)/dr

So (T - u*dp)/dr is the true count corresponding to the tags removed which must be added to the "raw" index (MDHA/AACpTCp) to give final index.

*Prove (T - u*dp)/dr = MT + YI so that Index = (MDHA / AACpTCp) + (T - u*dp)/dr*

dp = decks played, dr = decks remaining, n = number of decks = (dp + dr), u = unbalance per deck,

cp = cards played = 52*dp, cr = cards remaining = 52*dr, T = running count tags removed, tc = true count

(T - u*dp)/dr = T/dr - u*dp/dr = MT + YI: (formulas for MT and YI above use "k" for # of decks and "n" for cards played)

T /dr = T/(cr/52) = (T*52)/cr = (T*52)/(52*n - cp) = T*(52/(52*n - cp)) = MT

(-1)*u*dp/dr = (-1)*u*cp/cr = (-1)*u*cp/(52*n - cp) = YI

Indices using generalized LSL line.

(1) AACpTCp = m * [(51) / (52)], m = slope of generalized LSL through EoR and Tagged Values of Count under consideration

(2) EoR(n cards removed, k decks) = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)], puc = player's up card, duc = dealer's up card

(3) FDHA = Full Deck House Advantage. Estimated for "k" decks through Cubic Interpolation by Reciprocals (See Exhibit 5).

[For insurance and over/under 13 bet, FDHA does not vary by deck]

(4) MDHA = Modified Deck House Advantage = FDHA - EoR(n cards removed, k decks)

(5) MT = Modified Tag = Sum (Tags Removed) * [52 / (52*k - n)]

(6) YI = infinite deck Y-intercept adjustment = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = (-1) * u * { n / (52*k - n) }

(7) Idx = Index = { MDHA / AACpTCp } + MT + YI = (MDHA / AACpTCp) + (T - u*dp)/dr

(8) pa(t) = AACpTCp * (t - Idx), where pa(t) = player's advantage at true count "t". See Exhibit 7 for explanation.

Finite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Full Deck House Advantage (FDHA) calculated for "k" decks
Removal of Dealer's up card (and Player's up cards when available) TAKEN into consideration
"k" decks used in the calculation of Correlation Coefficient, AACpTCp and Critical Index

crn	Count Reference #	1		Count	**Red 7**
srn	Situation Reference #	4		Situation	**Insurance**
k_decks	*Number of Decks = k*	*6*	*puc1*	*Player's Up Card #1*	*n/a*
			puc2	*Player's Up Card #2*	*n/a*
			duc	*Dealer's Up Card*	*A*

(1) Cards Removed	(2) Player's Up Card 1 puc1	(3) Player's Up Card 2 puc2	(4) Dealer's Up Card duc	(5) = (2) + (3) + (4) Total Cards Removed	(6) Variable Name	(7) Tagged Value in Count (1)	(8) = (7) * (5) Tagged Value * Total Removed	(9) Variable Name
2	0	0	0	0	out_2	1.0	0	n/a
3	0	0	0	0	out_3	1.0	0	n/a
4	0	0	0	0	out_4	1.0	0	n/a
5	0	0	0	0	out_5	1.0	0	n/a
6	0	0	0	0	out_6	1.0	0	n/a
7	0	0	0	0	out_7	0.5	0	n/a
8	0	0	0	0	out_8	0.0	0	n/a
9	0	0	0	0	out_9	0.0	0	n/a
T	0	0	0	0	out_T	-1.0	0	n/a
A	0	0	1	1	out_A	-1.0	-1	n/a
Total	n/a	n/a	n/a	**1**	n_out	n/a	**-1**	sum_tags_out

Notes:

(1) tagged value of 7 taken as the average tag value of Red 7 and Black 7, so for the Red 7, (1+0)/2 = 0.5, since if a 7 is removed it could be either the Red 7 or Black 7.

Infinite Deck Calculation of Correlation Coefficient, Average Advantage Change per True Count point and Index Least Squares Line

Full Deck House Advantage (FDHA) calculated for infinite decks
Removal of Dealer's and Player's up cards NOT taken into consideration
Infinite Deck assumption in calculation of CC, AACpTCp and Crit. Index

Card	X Red 7 Count	Y Effect of Removal
Red 2	1	1.8100%
Black 2	1	1.8100%
Red 3	1	1.8100%
Black 3	1	1.8100%
Red 4	1	1.8100%
Black 4	1	1.8100%
Red 5	1	1.8100%
Black 5	1	1.8100%
Red 6	1	1.8100%
Black 6	1	1.8100%
Red 7	1	1.8100%
Black 7	0	1.8100%
Red 8	0	1.8100%
Black 8	0	1.8100%
Red 9	0	1.8100%
Black 9	0	1.8100%
Red 10	-1	-4.0724%
Black 10	-1	-4.0724%
Red J	-1	-4.0724%
Black J	-1	-4.0724%
Red Q	-1	-4.0724%
Black Q	-1	-4.0724%
Red K	-1	-4.0724%
Black K	-1	-4.0724%
Red A	-1	1.8100%
Black A	-1	1.8100%
Total	1.0000	0.0000%
mu = mean	0.0385	0.0000%
SD = STDDEVP(X-array)		0.8979
CC = CORREL(Y-array, X-array)		77.10%
m = slope = SLOPE(Y-array, X-array)		2.331%
AACpTCp = m * (51/52) (See Exhibit 2)		2.287%
Full Dk House Adv (FDHA), infinite dks		7.692% (Exhibit 5)
Index (FDHA / AACpTCp)		***3.36*** *(Infinite deck assumption)*

Count **Red 7**
Situation **Insurance**

Indices using generalized LSL line
Infinite Deck Assumption (k = infinity):

(1) AACpTCp = m * [(51) / (52)],
m = slope of generalized LSL with each of the 13 card denominations weighted equally.
(2) EoR(n cards removed, k decks) = 0
(3) FDHA infinite decks: See Exhibit 5
(4) MDHA = FDHA
(5) MT = Modified Tag = 0
(6) Idx = Index = FDHA / AACpTCp
(7) pa(t) = AACpTCp * (t - Idx) = AACpTCp * t - FDHA

Calculation of Y-intercept of LSL
b = Y-intercept of LSL, Y = m*X + b
b = uY - m*u X = -0.0897%
b = Intercept(Y-array, X-array) = -0.0897%

Exhibit J3 - Infinite Deck Red 7 Least Squares Line Sample Index Calculation for Insurance

Finite Deck Calculation of Indices
Proportional Deflection

Proportional Deflection:

Count	Red 7	Situation		Insurance	
k = # of Decks, k_decks	6			Player's Up Card #2, puc2	n/a
Player's Up Card #1, puc1	n/a			Dealer's Up Card, duc	A
		n = number of cards removed	1		

If rc = running count, cr = cards remaining, dr = decks remaining

tc = rc / dr — So tc' = rc / cr = rc / (52*dr) = (rc / dr) * (1/52)

tc' = rc / cr — So tc' = tc * (1/52)

cr = 52*dr — So tc' = (1/52) corresponds to tc = 1.0

k = # of decks	tc =	3.2102
6	tc' = (tc/52) =	0.0617

Calculated BALANCED "tc" (Col (2))
giving Expected Value = 0 as shown below.

Card	(1) X Red 7 Count	(2) x= X - uX *Balanced Count*	(3) F = freq k decks # of cards	(4) SS(x) = Sum Squares F*x^2	(5) "tc" Estimated # of cards removed (c)	(6) = (3) - (5) "tc" Est. # of cards remaining	(7) Y Effect of Removal (EoR)	(8) EoR(k,n) = 51 / (52*k - n) * EoR	(9) =(5) * (8) "tc = t" EoR removed cards
2	1.00	0.9582	24.00	22.0355	1.7629	22.2371	1.8100%	0.2968%	0.5232%
3	1.00	0.9582	24.00	22.0355	1.7629	22.2371	1.8100%	0.2968%	0.5232%
4	1.00	0.9582	24.00	22.0355	1.7629	22.2371	1.8100%	0.2968%	0.5232%
5	1.00	0.9582	24.00	22.0355	1.7629	22.2371	1.8100%	0.2968%	0.5232%
6	1.00	0.9582	24.00	22.0355	1.7629	22.2371	1.8100%	0.2968%	0.5232%
Red 7	1.00	0.9582	12.00	11.0178	0.8814	11.1186	1.8100%	0.2968%	0.2616%
Black 7	0.00	-0.0418	12.00	0.0210	(0.0385)	12.0385	1.8100%	0.2968%	-0.0114%
8	0.00	-0.0418	24.00	0.0419	(0.0769)	24.0769	1.8100%	0.2968%	-0.0228%
9	0.00	-0.0418	24.00	0.0419	(0.0769)	24.0769	1.8100%	0.2968%	-0.0228%
10	-1.00	-1.0418	24.00	26.0484	(1.9167)	25.9167	-4.0724%	-0.6678%	1.2800%
J	-1.00	-1.0418	24.00	26.0484	(1.9167)	25.9167	-4.0724%	-0.6678%	1.2800%
Q	-1.00	-1.0418	24.00	26.0484	(1.9167)	25.9167	-4.0724%	-0.6678%	1.2800%
K	-1.00	-1.0418	24.00	26.0484	(1.9167)	25.9167	-4.0724%	-0.6678%	1.2800%
A	-1.00	-1.0418	23.00	24.9630	(1.8368)	24.8368	1.8100%	0.2968%	-0.5452%
Total (a)	13.00	0.0000	311.00	250.4566	-	311.0000	-1.8100%	-0.2968%	7.3955%
mu = mean (b)	0.0418	0.0000						*card removed*	

(a) Tot(col (A)) = Sumproduct(Col (A), Col (3)) where A = (1), (2), (7), (8)

Totals of columns (3), (4), (5), (6) and (9) totals are straight column sums.

(b) Mean(col (A)) = Tot(Col (A)) / Tot(Col (3)) where A = (1), (2)

(c) [Estimated # cards of denomination "c" removed when true count = (tc')]

= (frequency of card denomination, "c") * [(tc') * (x) / Var(x)]

note: dim { (tc') } = dim (rc/cr) = dim (x)

since "rc" is the running count of the balanced count "x",

so dim { (tc') * (x) / Var(x)] } = dimensionless.

= F(c) * [(tc') * (x) * / { Sum (F*x^2) / (cr) }] since mean(x) = 0

note: cr = cards remaining = (52* k - n) where n = number of cards removed.

= F(c) * [(tc') * (x) * (cr) / Sum (F*x^2)] where (cr) = (52*k - n)

= col (3) * [(tc') * col (2) * (cr) / Tot (4)] where (cr) = (52*k - n)

EoR(puc1, single deck)	n/a	0.0000%
EoR(puc2, single deck)	n/a	0.0000%
EoR(duc, single deck)	A	1.8100%
Sum { EoR(puc1, puc2, duc) }	n/a	1.8100%
Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]		0.2968%
Total EoR removed cards		7.6923%
FDHA, k decks (Exhibit 5)		7.6923%
FDHA - Tot EoR removed cards	**House EV**	**0.0000%**
See Calculation of Index before Application of Modified Tag	tc =	3.2037
T = Sum(Tags Removed: col(1))		-1.0000
MT = Modified Tagged value = T * [52 / (52*k - n)]		-0.1672
Index (Idx) = tc + MT		***3.0365***

Finite Deck Calculation of Indices

Proportional Deflection

Calculation of Unmodified True Count corresponding to Expected Value = 0

k = # of decks	tc =	1.0000
6	tc' = (tc/52) =	0.0192

Choose "tc = 1.0000" and get total "tc = 1" EoR = Tot (9) for tc = 1.0000.

Card	(1) **X** Red 7 Count	(2) **x=** X - uX *Balanced Count*	(3) F = freq k decks # of cards	(4) SS(x) = Sum Squares F*x^2	(5) "tc" Estimated # of cards removed (c)	(6) = (3) - (5) "tc" Est. # of cards remaining	(7) **Y** Effect of Removal (EoR)	(8) EoR(k,n) = 51 / (52*k - n) * EoR	(9) =(5) * (8) "tc = t" EoR removed cards
2	1.00	0.9582	24.00	22.0355	0.5492	23.4508	1.8100%	0.2968%	0.1630%
3	1.00	0.9582	24.00	22.0355	0.5492	23.4508	1.8100%	0.2968%	0.1630%
4	1.00	0.9582	24.00	22.0355	0.5492	23.4508	1.8100%	0.2968%	0.1630%
5	1.00	0.9582	24.00	22.0355	0.5492	23.4508	1.8100%	0.2968%	0.1630%
6	1.00	0.9582	24.00	22.0355	0.5492	23.4508	1.8100%	0.2968%	0.1630%
Red 7	1.00	0.9582	12.00	11.0178	0.2746	11.7254	1.8100%	0.2968%	0.0815%
Black 7	0.00	-0.0418	12.00	0.0210	(0.0120)	12.0120	1.8100%	0.2968%	-0.0036%
8	0.00	-0.0418	24.00	0.0419	(0.0240)	24.0240	1.8100%	0.2968%	-0.0071%
9	0.00	-0.0418	24.00	0.0419	(0.0240)	24.0240	1.8100%	0.2968%	-0.0071%
10	-1.00	-1.0418	24.00	26.0484	(0.5971)	24.5971	-4.0724%	-0.6678%	0.3987%
J	-1.00	-1.0418	24.00	26.0484	(0.5971)	24.5971	-4.0724%	-0.6678%	0.3987%
Q	-1.00	-1.0418	24.00	26.0484	(0.5971)	24.5971	-4.0724%	-0.6678%	0.3987%
K	-1.00	-1.0418	24.00	26.0484	(0.5971)	24.5971	-4.0724%	-0.6678%	0.3987%
A	-1.00	-1.0418	23.00	24.9630	(0.5722)	23.5722	1.8100%	0.2968%	-0.1698%
Total (a)	13.00	0.0000	311.00	250.4566	-	311.0000	-1.8100%	-0.2968%	2.3038%
mu = mean (b)	0.0418	0.0000							

Tot (9) = { EoR:PD @ tc = +1 } = AACpTCp from Exhibit J2

Find "tc = t" so House Expected Value (EV) is zero:

tc	=	1.0000	AACpTCp	Exhibit J2
Tot (9)	=	2.3038%	2.3038%	Exhibit J2

t *	2.3038%
+	0.2968%
=	7.6923%

t =True Count Index before modification

t = 3.2102

	card removed	
EoR(puc1, single deck)	n/a	0.0000%
EoR(puc2, single deck)	n/a	0.0000%
EoR(duc, single deck)	A	1.8100%
Sum { EoR(puc1, puc2, duc) }	n/a	1.8100%
Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]		0.2968%
Total EoR removed cards		2.6006%
FDHA, k decks (Exhibit 5)		7.6923%
FDHA - Tot EoR removed cards	**House EV**	**5.0917%**

Note:

Let EoR:(n,k) = EoR from "n" cards removed from "k" decks = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]

Then above equation says: t * (AACpTCp) + EoR:(n,k) = FDHA

From LSL definition in Exhibit 2: MDHA = Modified Deck House Advantage = FDHA - EoR:(n,k)

so t = (FDHA - EoR:(n,k)) / AACpTCp = MDHA / AACpTCp which is the first term of the Idx calculation from LSL procedure, Exhibit 2.

Finite Deck Calculation of Indices
Proportional Deflection

Calculation of Index Before Application of Modified Tag Value

k = # of decks
6

tc =	3.2102	*Calculated BALANCED "tc" (Col (2))*
tc' = (tc/52) =	0.0617	*giving Expected Value = 0 as shown above.*

Card	(1) **X** Red 7 Count	(2) **x=** X - uX *Balanced Count*	(3) One Full Deck	Full Deck Ending Count: Red 7 (1a) = (1)*(3)	Full Deck Ending Count: *Balanced Count* (2a) = (2)*(3)	(5) "tc" Estimated # of cards removed (c)	***Running Counts*** (1b) = (1)*(5) Red 7	***Running Counts*** (2b) = (2)*(5) *Balanced Count*
2	1.00	0.9582	4.0000	4.0000	3.8328	1.7629	1.7629	1.6892
3	1.00	0.9582	4.0000	4.0000	3.8328	1.7629	1.7629	1.6892
4	1.00	0.9582	4.0000	4.0000	3.8328	1.7629	1.7629	1.6892
5	1.00	0.9582	4.0000	4.0000	3.8328	1.7629	1.7629	1.6892
6	1.00	0.9582	4.0000	4.0000	3.8328	1.7629	1.7629	1.6892
Red 7	1.00	0.9582	2.0000	2.0000	1.9164	0.8814	0.8814	0.8446
Black 7	0.00	-0.0418	2.0000	0.0000	-0.0836	(0.0385)	0.0000	0.0016
8	0.00	-0.0418	4.0000	0.0000	-0.1672	(0.0769)	0.0000	0.0032
9	0.00	-0.0418	4.0000	0.0000	-0.1672	(0.0769)	0.0000	0.0032
10	-1.00	-1.0418	4.0000	-4.0000	-4.1672	(1.9167)	1.9167	1.9968
J	-1.00	-1.0418	4.0000	-4.0000	-4.1672	(1.9167)	1.9167	1.9968
Q	-1.00	-1.0418	4.0000	-4.0000	-4.1672	(1.9167)	1.9167	1.9968
K	-1.00	-1.0418	4.0000	-4.0000	-4.1672	(1.9167)	1.9167	1.9968
A	-1.00	-1.0418	4.0000	-4.0000	-4.1672	(1.8368)	1.8368	1.9136
Total	n/a	n/a	52.0000	**2.0000**	**-0.1736**	-	**19.1992**	**19.1992**
Unbalance per Deck = u						u =	2.0000	-0.1736
Number or Decks = n						n =	6.0000	6.0000
Total Unbalance for "n" decks = Unbalance Per Deck * Number of Decks = u * n						u*n =	12.0000	-1.0418
Critical True Count Before Application of Modified Tag Value = u + { rc - u*n } / dr							**3.2037**	3.2107

Red 7	rc = running count, n = number of decks, dr = decks remaining					
Unbalance Per Deck	2.0000		Cards Remaining		311.00	
Number or Decks, n	6		Decks Remaining		5.9808	
True Count	***2.0000***	***+***	***(rc -***	***2.0000***	**** n) / dr***	

__Generalized True Count__
*True Count = (unbalanced count per deck) + { (running count) - (unbalanced count per deck) * (# of decks) } / (decks remaining)*
If tc = true count, rc = running count, u = unbalanced count per deck, n = number of decks, dr = decks remaining, dp = decks played then:
tc = u + (rc - u*n) / dr = (rc - u*dp) / dr

__Notes:__
(1) tc = u + (rc - u*n) / dr. n = # decks = (dp + dr) and so tc = (rc - u*dp)/dr.
Note that u*dp = expected unbalance when "dp" decks are played so (rc - u*dp) = expected equivalent balanced running count.
(2) For Red 7, u = 2.00, so tc = 2 + (rc - 2*n) / dr (3) For Hi-Low, u = 0, so tc = rc / dr
(4) For KO (counts all 7's as +1, not just the Red 7's), u = 4.00, so tc = 4 + (rc - 4*n) / dr

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

Cubic Interpolation by Reciprocals
Y = A3*X^3 + A2*X^2 + A1*X + A0
Note: Since X = (1/k) = (k)^(-1), where k = # decks, then Y = A3*(k^(-3)) + A2*(k^(-2)) + A1*(k^(-1)) + A0 = A3*(1/k^3) + A2*(1/k^2) + A1*(1/k) + A0

crn	Count Reference #	1
srn	Situation Reference #	4
k_decks	k = number of decks	6
	Count	Red 7
	Situation	Insurance

Insurance	
k	FDHA(k)
1	7.6923%
2	7.6923%
6	7.6923%
8	7.6923%

Y =	0.00000%	* X^3	+	0.00000%	* X^2	+	0.00000%	* X	+	7.69231%

Decks	**6**
Situation	Insurance

			FDHA(k)		
k decks	situation	X = (1/k)	**Y cubic**	Y linear *	Y linear - cubic
6	Insurance	0.16667	**7.6923%**	7.6923%	0.0000%
infinite	Insurance	0	**7.6923%**	7.6923%	0.0000%

* Y linear: see Exhibit 10A :

FDHA(k) = FDHA(1) * { (1/7) * (8/k - 1) } + FDHA(8) * { (8/7) * (1 - (1/k)) }
= FDHA(1) * { (1/7) * (8*X - 1) } + FDHA(8) * { (8/7) * (1 - X)) }, X = (1/k)

Insurance
FDHA = Full Deck House Advantage
Cubic Interpolation by Reciprocals

k	X = (1/k)	FDHA(k) from BJA3	FDHA(k) Y cubic	Difference BJA3 - Y cubic	FDHA(k) Y linear *	Difference Y linear - cubic
1	1.0000	7.6923%	7.6923%	0.0000%	7.6923%	0.0000%
2	0.5000	7.6923%	7.6923%	0.0000%	7.6923%	0.0000%
3	0.3333	n/a	7.6923%	n/a	7.6923%	0.0000%
4	0.2500	n/a	7.6923%	n/a	7.6923%	0.0000%
5	0.2000	n/a	7.6923%	n/a	7.6923%	0.0000%
6	0.1667	7.6923%	7.6923%	0.0000%	7.6923%	0.0000%
7	0.1429	n/a	7.6923%	n/a	7.6923%	0.0000%
8	0.1250	7.6923%	7.6923%	0.0000%	7.6923%	0.0000%
1000	0.0010	n/a	7.6923%	n/a	7.6923%	0.0000%
infinite	0.0000	n/a	7.6923%	n/a	7.6923%	0.0000%

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

Insurance

k	X = (1/k)	X^2	X^3	FDHA(k) from BJA3 Y
1	1.0000	1.0000	1.0000	7.6923%
2	0.5000	0.2500	0.1250	7.6923%
6	0.1667	0.0278	0.0046	7.6923%
8	0.1250	0.0156	0.0020	7.6923%

A3	*	X^3	+	A2	*	X^2	+	A1	*	X	+	A0	=	Y
A3	*	1.0000	+	A2	*	1.0000	+	A1	*	1.0000	+	A0	=	7.6923%
A3	*	0.1250	+	A2	*	0.2500	+	A1	*	0.5000	+	A0	=	7.6923%
A3	*	0.0046	+	A2	*	0.0278	+	A1	*	0.1667	+	A0	=	7.6923%
A3	*	0.0020	+	A2	*	0.0156	+	A1	*	0.1250	+	A0	=	7.6923%

Four Linear Equations, Four Unknowns

Cramer's Rule

1.0000	**1.0000**	**1.0000**	**1.0000**	**7.6923%**	**A3**	**=**	**0.00000%**
0.1250	**0.2500**	**0.5000**	**1.0000**	**7.6923%**	**A2**	**=**	**0.00000%**
0.0046	**0.0278**	**0.1667**	**1.0000**	**7.6923%**	**A1**	**=**	**0.00000%**
0.0020	**0.0156**	**0.1250**	**1.0000**	**7.6923%**	**A0**	**=**	**7.69231%**

A3	=	D:A3 / D	=	0.000000000	/	0.001898872
A3	=	0.0000000				
A2	=	D:A2 / D	=	0.000000000	/	0.001898872
A2	=	0.0000000				
A1	=	D:A1 / D	=	0.000000000	/	0.001898872
A1	=	0.0000000				
A0	=	D:A0 / D	=	0.000146067	/	0.001898872
A0	=	0.0769231				

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	1.0000000	1.0000000					
D	**=**	0.1250000	0.2500000	0.5000000	1.0000000	=	0.001898872			
		0.0046296	0.0277778	0.1666667	1.0000000					
		0.0019531	0.0156250	0.1250000	1.0000000					

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.04166667	+	0.00781250	+	0.00347222		
		-	0.00260417	-	0.03125000	-	0.01388889		
1.0000000	*		0.00520833					=	0.005208333
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.16666667	+	0.01562500	+	0.00347222		
		-	0.00260417	-	0.12500000	-	0.02777778		
-0.1250000	*		0.03038194					=	-0.003797743
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000			
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000			
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000			
		+	0.50000000	+	0.01562500	+	0.03125000		
		-	0.00781250	-	0.12500000	-	0.25000000		
0.0046296	*		0.16406250					=	0.000759549
		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000			
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000			
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667			
		+	0.50000000	+	0.02777778	+	0.04166667		
		-	0.01388889	-	0.16666667	-	0.25000000		
-0.0019531	*		0.13888889					=	-0.000271267
							D	**=**	0.001898872

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		0.0769231	1.0000000	1.0000000	1.0000000		
D:A3	**=**	*0.0769231*	0.2500000	0.5000000	1.0000000	=	0.000000000
		0.0769231	0.0277778	0.1666667	1.0000000		
		0.0769231	0.0156250	0.1250000	1.0000000		

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.04166667	+	0.00781250	+	0.00347222	
		-	0.00260417	-	0.03125000	-	0.01388889	
0.0769231	*		0.00520833				=	0.000400641
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.16666667	+	0.01562500	+	0.00347222	
		-	0.00260417	-	0.12500000	-	0.02777778	
-0.0769231	*		0.03038194				=	-0.002337073
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.50000000	+	0.01562500	+	0.03125000	
		-	0.00781250	-	0.12500000	-	0.25000000	
0.0769231	*		0.16406250				=	0.012620192
		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000		
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000		
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667		
		+	0.50000000	+	0.02777778	+	0.04166667	
		-	0.01388889	-	0.16666667	-	0.25000000	
-0.0769231	*		0.13888889				=	-0.010683761
							D:A3 =	0.000000000

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	*0.0769231*	1.0000000	1.0000000					
D:A2	**=**	0.1250000	*0.0769231*	0.5000000	1.0000000	=	0.000000000			
		0.0046296	*0.0769231*	0.1666667	1.0000000					
		0.0019531	*0.0769231*	0.1250000	1.0000000					

		0.07692308	0.50000000	1.00000000	0.07692308	0.50000000			
		0.07692308	0.16666667	1.00000000	0.07692308	0.16666667			
		0.07692308	0.12500000	1.00000000	0.07692308	0.12500000			
		+	0.01282051	+	0.03846154	+	0.00961538		
		-	0.01282051	-	0.00961538	-	0.03846154		
1.0000000	*		0.00000000					=	0.000000000
		0.07692308	1.00000000	1.00000000	0.07692308	1.00000000			
		0.07692308	0.16666667	1.00000000	0.07692308	0.16666667			
		0.07692308	0.12500000	1.00000000	0.07692308	0.12500000			
		+	0.01282051	+	0.07692308	+	0.00961538		
		-	0.01282051	-	0.00961538	-	0.07692308		
-0.1250000	*		0.00000000					=	0.000000000
		0.07692308	1.00000000	1.00000000	0.07692308	1.00000000			
		0.07692308	0.50000000	1.00000000	0.07692308	0.50000000			
		0.07692308	0.12500000	1.00000000	0.07692308	0.12500000			
		+	0.03846154	+	0.07692308	+	0.00961538		
		-	0.03846154	-	0.00961538	-	0.07692308		
0.0046296	*		0.00000000					=	0.000000000
		0.0769231	1.0000000	1.0000000	0.07692308	1.00000000			
		0.0769231	0.5000000	1.0000000	0.07692308	0.50000000			
		0.0769231	0.1666667	1.0000000	0.07692308	0.16666667			
		+	0.03846154	+	0.07692308	+	0.01282051		
		-	0.03846154	-	0.01282051	-	0.07692308		
-0.0019531	*		0.00000000					=	0.000000000
							D:A2	**=**	0.000000000

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	*0.0769231*	1.0000000				
D:A1	**=**	0.1250000	0.2500000	*0.0769231*	1.0000000	=	0.000000000		
		0.0046296	0.0277778	*0.0769231*	1.0000000				
		0.0019531	0.0156250	*0.0769231*	1.0000000				
			0.25000000	0.07692308	1.00000000	0.25000000	0.07692308		
			0.02777778	0.07692308	1.00000000	0.02777778	0.07692308		
			0.01562500	0.07692308	1.00000000	0.01562500	0.07692308		
			+	0.01923077	+	0.00120192	+	0.00213675	
			-	0.00120192	-	0.01923077	-	0.00213675	
1.0000000	*			0.00000000				=	0.000000000
			1.00000000	0.07692308	1.00000000	1.00000000	0.07692308		
			0.02777778	0.07692308	1.00000000	0.02777778	0.07692308		
			0.01562500	0.07692308	1.00000000	0.01562500	0.07692308		
			+	0.07692308	+	0.00120192	+	0.00213675	
			-	0.00120192	-	0.07692308	-	0.00213675	
-0.1250000	*			0.00000000				=	0.000000000
			1.00000000	0.07692308	1.00000000	1.00000000	0.07692308		
			0.25000000	0.07692308	1.00000000	0.25000000	0.07692308		
			0.01562500	0.07692308	1.00000000	0.01562500	0.07692308		
			+	0.07692308	+	0.00120192	+	0.01923077	
			-	0.00120192	-	0.07692308	-	0.01923077	
0.0046296	*			0.00000000				=	0.000000000
			1.0000000	0.0769231	1.0000000	1.00000000	0.07692308		
			0.2500000	0.0769231	1.0000000	0.25000000	0.07692308		
			0.0277778	0.0769231	1.0000000	0.02777778	0.07692308		
			+	0.07692308	+	0.00213675	+	0.01923077	
			-	0.00213675	-	0.07692308	-	0.01923077	
-0.0019531	*			0.00000000				=	0.000000000
								D:A1	**=** 0.000000000

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	1.0000000	*0.0769231*		
D:A0	**=**	0.1250000	0.2500000	0.5000000	*0.0769231*	=	0.000146067
		0.0046296	0.0277778	0.1666667	*0.0769231*		
		0.0019531	0.0156250	0.1250000	*0.0769231*		

		0.25000000	0.50000000	0.07692308	0.25000000	0.50000000		
		0.02777778	0.16666667	0.07692308	0.02777778	0.16666667		
		0.01562500	0.12500000	0.07692308	0.01562500	0.12500000		
		+	0.00320513	+	0.00060096	+	0.00026709	
		-	0.00020032	-	0.00240385	-	0.00106838	
1.0000000	*		0.00040064				=	0.000400641
		1.00000000	1.00000000	0.07692308	1.00000000	1.00000000		
		0.02777778	0.16666667	0.07692308	0.02777778	0.16666667		
		0.01562500	0.12500000	0.07692308	0.01562500	0.12500000		
		+	0.01282051	+	0.00120192	+	0.00026709	
		-	0.00020032	-	0.00961538	-	0.00213675	
-0.1250000	*		0.00233707				=	-0.000292134
		1.00000000	1.00000000	0.07692308	1.00000000	1.00000000		
		0.25000000	0.50000000	0.07692308	0.25000000	0.50000000		
		0.01562500	0.12500000	0.07692308	0.01562500	0.12500000		
		+	0.03846154	+	0.00120192	+	0.00240385	
		-	0.00060096	-	0.00961538	-	0.01923077	
0.0046296	*		0.01262019				=	0.000058427
		1.0000000	1.0000000	0.0769231	1.00000000	1.00000000		
		0.2500000	0.5000000	0.0769231	0.25000000	0.50000000		
		0.0277778	0.1666667	0.0769231	0.02777778	0.16666667		
		+	0.03846154	+	0.00213675	+	0.00320513	
		-	0.00106838	-	0.01282051	-	0.01923077	
-0.0019531	*		0.01068376				=	-0.000020867
							D:A0 **=**	0.000146067

Calculation of Correlation Coefficients and
Average Advantage Change per True Count point

Fit a Least Square Line (LSL) between X {tag value of cards in count} & Y {effects of removal of each card}

Slope of the LSL = Sum (x*y) / (Sum (x^2))

{note: dimensions [slope] = dim(x*y) / dim (x^2) = dim(y) / dim(x) = rise / run}

where x = X - mean (X) and y = Y - mean (Y)

Correlation Coefficient = Sum (x*y) / SQRT (Sum (x^2) * Sum (y^2))

{note: dimensions [Corr. Coef.] = [dim(x)*dim(y)] / [dim (x^2)^(1/2) * dim (y^2)^(1/2)], CC is dimensionless}

AACpTCp (Average Advantage Change per True Count Point) =
Slope of LSL adjusted to the average advantage change for a full pack of 52 cards.

x = X - uX where uX = Mean(X)
Sum(Y) = sum of effects of removal = 0, so uY = 0
y = Y - uY where uY = Mean(Y), y = Y since uY = 0
Corr Coef = Sum(x*y) / SQRT [Sum(x^2) * Sum(y^2)]
m = Slope LSL = Sum(x*y) / Sum(x^2)
b = Y-intercept of LSL = mean (Y) - m * Mean(X) = uY - m * uX
AACpTCp = m * (51/52) = Slope LSL * (51/52)

Indices using generalized LSL line. *(See "Finite Deck Calculation" examples in Exhibits I2 and J2)*

(1) AACpTCp = m * [(51) / (52)], m = slope of generalized LSL through EoR and Tagged Values of Count under consideratio
(2) EoR(n cards removed, k decks) = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)], puc = player's up card, duc = dealer's up card
(3) FDHA = Full Deck House Advantage. Estimated for "k" decks through Cubic Interpolation by Reciprocals (See Exhibit 5).
[For insurance and over/under 13 bet, FDHA does not vary by deck]
(4) MDHA = Modified Deck House Advantage = FDHA - EoR(n cards removed, k decks)
(5) MT = Modified Tag = Sum (Tags Removed) * [52 / (52*k - n)]
(6) YI = infinite deck Y-intercept adjustment = n * { b:inf * [51 / (52*k - n)] / AACpTCp:inf } = (-1) * u * { n / (52*k - n) }
(7) Idx = Index = { MDHA / AACpTCp } + MT + YI
(8) pa(t) = AACpTCp * (t - Idx), where pa(t) = player's advantage at true count "t". See Exhibit 7 for explanation.

Calculation of Correlation Coefficients and Average Advantage Change per True Count point

Infinite Deck Assumption (k = infinity) *(See "Infinite Deck Calculation" examples in Exhibits I3 and J3)*

(1) AACpTCp = m * [(51) / (52)], m = slope of generalized LSL with each of the 13 card denominations weighted equally.

(2) EoR(n cards removed, k decks) = 0 (as "k" approaches infinity 51 / (52*k - n) in EoR formula approaches zero)

(3) FDHA = Full Deck House Advantage. Estimated for "k" decks through Cubic Interpolation by Reciprocals (See Exhibit 5).

[For insurance and over/under 13 bet, FDHA does not vary by deck]

(4) MDHA = FDHA (EoR(n cards removed, k decks) = 0, see (2) above)

(5) MT = Modified Tag = 0 (as "k" approaches infinity 51 / (52*k - n) in MT formula approaches zero)

(6) YI = infinite deck Y-intercept adjustment = 0 (as "k" approaches infinity 51 / (52*k - n) in YI formula approaches zero)

(7) Idx = Index = FDHA / AACpTCp

(8) pa(t) = AACpTCp * (t - Idx) = AACpTCp * t - FDHA since for infinite decks, Idx = FDHA / AACpTCp

Correlation Coefficient and Slope

CC = Correlation Coefficient of Y and X

m = slope of Y and X

n = # of observations (# of ordered pairs (X,Y))

CC = E(x*y) / SQRT [E(x^2) * E(y^2)]

= Sum(x*y) / SQRT [Sum(x^2) * Sum(y^2)]

m = E(x*y) / E(x^2)

= Sum(x*y) / Sum(x^2)

E(X) = uX = expected value of X

x = X - E(X) = X - uX

Note: E(x) = E(X - uX) = E(X) - uX = 0

E(x^2) = E((X - uX)^2) = E(X^2) - (uX)^2

E(y^2) = E((Y - uY)^2) = E(Y^2) - (uY)^2

E(x*y) = E((X-uX)*(Y-uY)) = E(X*Y) - (uX)*(uY)

E(X*Y) = Sum(X*Y) / n

E(x*y) = E((X-uX)*(Y-uY)) = E(XY) - (uX)*(uY)

= { Sum(X*Y) / n } - (uX) * (uY)

E(X^2) = Sum(X^2) / n

E(x^2) = E((X - uX)^2) = E(X^2) - (uX)^2

= { Sum(X^2) / n } - (uX)^2

CC = E(x*y) / SQRT [E(x^2) * E(y^2)] (dimensionless)

= [{ Sum(X*Y) / n } - (uX) * (uY)] / SQRT { [{ Sum(X^2) / n } - (uX)^2] * [{ Sum(Y^2) / n } - (uY)^2] }

= [Sum(X*Y) - n * (uX) * (uY)] / SQRT { [Sum(X^2) - n * (uX)^2] * [Sum(Y^2) - n * (uY)^2] }

m = E(x*y) / E(x^2) (dimensions = dim(y) / dim(x) = rise / run)

= [{ Sum(X*Y) / n } - (uX) * (uY)] / [{ Sum(X^2) / n } - (uX)^2]

= [Sum(X*Y) - n * (uX) * (uY)] / [Sum(X^2) - n * (uX)^2]

Calculation of Correlation Coefficients and Average Advantage Change per True Count point

Under a linear transformation, the Correlation Coefficient is invariant

Prove: T is a linear transformation of X: T = a*X + b
If a > 0, then CC(T,Y) = CC(X,Y)
If a < 0 , then CC(T,Y) = (-1)* CC(X,Y)

Proof:
Let count T be a linear transformation of count X.
Then T = a*X + b where "a" and "b" are constants

CC = E(x*y) / SQRT [E(x^2) * E(y^2)]

E(x*y) = E((X-uX)*(Y-uY)) = E(X*Y) - (uX)*(uY)
E(x^2) = E((X - uX)^2) = E(X^2) - (uX)^2
E(y^2) = E((Y - uY)^2) = E(Y^2) - (uY)^2

E(x*y) = E((X-uX)*(Y-uY)) = E(XY) - (uX)*(uY)
proof:
(X-uX)*(Y-uY) = X*Y - X*uY - uX*Y + uX*uY
E(x*y) = E(X*Y) - uY*E(X) - uX*E(Y) + E(uX*uY)
E(x*y) = E(X*Y) - uY*uX - uX*uY + uX*uY
E(x*y) = E(X*Y) - uX*uY

so
CC = E{ (X-uX)*(Y-uY) } / SQRT { E(X-uX)^2 * E(Y-uY)^2 }

CC = { E(X*Y) - (uX)*(uY) } / SQRT { [(E(X^2) - (uX)^2] * [E(Y^2) - (uY)^2] }

Count T is a linear transformation of count X, so T= a*X + b

CC(X,Y) = { E(X*Y) - (uX)*(uY) } / SQRT { [(E(X^2) - (uX)^2] * [E(Y^2) - (uY)^2] }
CC(T,Y) = { E(T*Y) - (uT)*(uY) } / SQRT { [(E(T^2) - (uT)^2] * [E(Y^2) - (uY)^2] }

T*Y = (aX+b)*Y = aX*Y + b*Y
E(T*Y) = a*E(X*Y) + b*E(Y) = a*E(X*Y) + b*uY
uT = E(T) = E(aX + b) = a*E(X) + E(b) = a*uX + b
E(T*Y) - (uT)*(uY) = a* { E(X*Y) - (uX)*(uY) }

T^2 = (aX+b)^2 = (aX)^2 + 2*(aX)*(b) + b^2 = (a^2)*X^2 + (2ab)*X + b^2
E(T^2) = a^2*E(X^2) + 2ab*E(X) + b^2 = a^2*E(X^2) + 2ab*(uX) + b^2
(uT)^2 = (a*uX +b)^2 = a^2*(uX)^2 + 2ab*(uX) + b^2
E(T^2) - (uT)^2 = a^2 * { E(X^2) - (uX)^2 }

Calculation of Correlation Coefficients and Average Advantage Change per True Count point

CC(T,Y) = { E(T*Y) - (uT)*(uY) } / SQRT { [(E(T^2) - (uT)^2] * [E(Y^2) - (uY)^2] }

CC(T,Y) = a *{ E(X*Y) - (uX)*(uY) } / SQRT { [a^2 * ((E(X^2) - (uX)^2)] * [E(Y^2) - (uY)^2] }

CC(T,Y) = (a / SQRT (a^2)) * { E(X*Y) - (uX)*(uY) } / SQRT { [(E(X^2) - (uX)^2] * [E(Y^2) - (uY)^2] } = (a / SQRT (a^2)) * CC(X,Y)

If a > 0 then SQRT (a^2) = a, If a < 0 then SQRT (a^2) = (-1)* a. Therefore, SQRT(a^2) = AV(a) where AV = Absolute Value

So { a / SQRT(a^2) } = { a / AV(a) } = SIGN (a) where SIGN (a) = +1 if a > 0, 0 if a = 0 and -1 if a < 0.

CC(T, Y) = (SIGN (a)) * CC(X,Y)

CC(aX + b, Y) = SIGN(a) * CC(X,Y)			
Linear Transformation T = a*X + b		a =	-2.000
EoR: betting, S17, DAS, no LS		b =	0.500
Card	Effect of Removal	**X** Count	T T = a*X + b
2	0.3809%	1	-1.5
3	0.4339%	1	-1.5
4	0.5680%	1	-1.5
5	0.7274%	1	-1.5
6	0.4118%	1	-1.5
7	0.2823%	0	0.5
8	-0.0033%	0	0.5
9	-0.1731%	0	0.5
10	-0.5121%	-1	2.5
J	-0.5121%	-1	2.5
Q	-0.5121%	-1	2.5
K	-0.5121%	-1	2.5
A	-0.5794%	-1	2.5
Total	0.0001%	0.0000	6.5000
CORREL(Y,X)		96.48%	-96.48%

Calculation of Slope and Intercept
of Least Squares Line (LSL)

Y = m * X + b

EoR is shown if from Blackjack Attack, 3rd edition, for Betting, S17, DAS, no LS, six decks

Count shown is unbalanced but is NOT the Red 7

since all Sevens are counted as 0.5. Red 7 counts Red 7 as +1 & Black 7 as 0

Card	(1) X Count	(2) Y Effect of Removal	(3) x = X - uX	(4) y = Y - uY	(5) x*y	(6) x^2	(7) y^2
2	1	0.3809%	0.9615	0.3809%	0.3663%	0.9246	0.0015%
3	1	0.4339%	0.9615	0.4339%	0.4172%	0.9246	0.0019%
4	1	0.5680%	0.9615	0.5680%	0.5462%	0.9246	0.0032%
5	1	0.7274%	0.9615	0.7274%	0.6994%	0.9246	0.0053%
6	1	0.4118%	0.9615	0.4118%	0.3960%	0.9246	0.0017%
7	0.5	0.2823%	0.4615	0.2823%	0.1303%	0.2130	0.0008%
8	0	-0.0033%	-0.0385	-0.0033%	0.0001%	0.0015	0.0000%
9	0	-0.1731%	-0.0385	-0.1731%	0.0067%	0.0015	0.0003%
10	-1	-0.5121%	-1.0385	-0.5121%	0.5318%	1.0784	0.0026%
J	-1	-0.5121%	-1.0385	-0.5121%	0.5318%	1.0784	0.0026%
Q	-1	-0.5121%	-1.0385	-0.5121%	0.5318%	1.0784	0.0026%
K	-1	-0.5121%	-1.0385	-0.5121%	0.5318%	1.0784	0.0026%
A	-1	-0.5794%	-1.0385	-0.5794%	0.6017%	1.0784	0.0034%
Total (a)	0.5000	0.0001%	0.0000	0.0000%	5.2909%	10.2308	0.0285%
mu = mean	0.0385	0.0000%	0.0000	0.0000%	n/a	n/a	n/a

(a) Sum(EoR) = 0. If not zero, error is due to rounding of each EoR to nearest 0.0001%.

Corr Coef = Sum(x*y) / SQRT [Sum(x^2) * Sum(y^2)] = Tot (5) / SQRT [Tot(6) * Tot(7)]	98.00%
m = slope = Sum(x*y) / Sum (x^2) = (Tot (5) / Tot (6))	0.5172%
b = Y-intercept = uY - m * uX = mean(column(2)) - m * mean(column(1))	-0.0199%
Average Advantage Change per True Count point (AACpTCp) = m * (51/52)	0.5072%
Full Deck House Advantage (FDHA), infinite decks (Exhibit L4)	0.5142%
Index (FDHA / AACpTCp) (Infinite Deck Assumption, or no recognition of any cards removed)	1.01

Notes:

Excel functions: CORREL, SLOPE, and INTERCEPT

CC = CORREL(Y-array, X-array) = CORREL(Column(2), Column(1))	*98.00%*
m = SLOPE(Y-array, X-array) = SLOPE(Column(2), Column(1))	*0.5172%*
b = Y-intercept = INTERCEPT(Y-array,X-array) = INTERCEPT(Column(2),Column(1))	*-0.0199%*
*Average Advantage Change per True Count point (AACpTCp) = m * (51/52)*	*0.5072%*
Full Deck House Advantage (FDHA), infinite decks (Exhibit L4)	*0.5142%*
Index (FDHA / AACpTCp) (Infinite Deck Assumption, or no recognition of any cards removed)	*1.01*

Check:

CC = Sum(x*y) / SQRT [Sum(x^2) * Sum(y^2)]
= [Sum(X*Y) - n * (uX) * (uY)] / SQRT { [Sum(X^2) - n * (uX)^2] * [Sum(Y^2) - n * (uY)^2] }

m = Sum(x*y) / Sum(x^2)
= [Sum(X*Y) - n * (uX) * (uY)] / [Sum(X^2) - n * (uX)^2]

Sum(X*Y) = SUMPRODUCT(Col(1), Col(2))	5.2910%	uX = mean(X) = AVERAGE (Col(1))	0.0385
Sum(X^2) = SUMPRODUCT(Col(1), Col(1))	10.2500	uY = mean(Y) = AVERAGE (Col(2))	0.0000%
Sum(Y^2) = SUMPRODUCT(Col(2), Col(2))	0.0285%	n = number of ordered pairs (X,Y) analyzed	**13**
Sum(X*Y) - n * (uX) * (uY)	5.2909%	CC = Correlation Coefficient	98.00%
Sum(X^2) - n * (uX)^2	10.2308	m = Slope of LSL	0.5172%
Sum(Y^2) - n * (uY)^2	0.0003		

Calculation of Correlation Coefficients and
Average Advantage Change per True Count Point
and Critical Index for Basic Strategy Variations or Betting

For Red 7 Count

EoR is shown if from Blackjack Attack, 3rd edition, for Betting, S17, DAS, no LS, six decks

(x = equivalent balanced count to unbalanced X, i.e. Red 7)

Card	(i) X Unbalanced Red 7 Count	(ii) x = X - uX Balanced Red 7	(iii) Y Effect of Removal
Red 2	1	0.9615	0.3809%
Black 2	1	0.9615	0.3809%
Red 3	1	0.9615	0.4339%
Black 3	1	0.9615	0.4339%
Red 4	1	0.9615	0.5680%
Black 4	1	0.9615	0.5680%
Red 5	1	0.9615	0.7274%
Black 5	1	0.9615	0.7274%
Red 6	1	0.9615	0.4118%
Black 6	1	0.9615	0.4118%
Red 7	1	0.9615	0.2823%
Black 7	0	-0.0385	0.2823%
Red 8	0	-0.0385	-0.0033%
Black 8	0	-0.0385	-0.0033%
Red 9	0	-0.0385	-0.1731%
Black 9	0	-0.0385	-0.1731%
Red 10	-1	-1.0385	-0.5121%
Black 10	-1	-1.0385	-0.5121%
Red J	-1	-1.0385	-0.5121%
Black J	-1	-1.0385	-0.5121%
Red Q	-1	-1.0385	-0.5121%
Black Q	-1	-1.0385	-0.5121%
Red K	-1	-1.0385	-0.5121%
Black K	-1	-1.0385	-0.5121%
Red A	-1	-1.0385	-0.5794%
Black A	-1	-1.0385	-0.5794%
Total (a)	1.0000	0.0000	0.0002%
mu = mean	0.0385	0.0000	0.0000%

(a) Sum(EoR) = 0. If not zero, error is due to rounding of each EoR to nearest 0.0001%.

Excel functions: CORREL, SLOPE, and INTERCEPT: Applied to x = Col (ii) and Y = Col (iii)

CORREL(Y-array, x-array) = CORREL(Col (iii), Col (ii))		96.83%
m = slope = SLOPE(Y-array, x-array)		0.5048%
b = Y-intercept = INTERCEPT(Y-array, x-array) = INTERCEPT(Column(iii), Column(ii))		0.0000%
Average Advantage Change per True Count point (AACpTCp) = m * (51/52)		0.4951%
Full Deck House Advantage (FDHA), Infinite decks		0.5142%
Index (FDHA / AACpTCp)	*(Infinite Deck Assumption, or no recognition of any cards removed)*	1.04

Excel functions: CORREL, SLOPE, and INTERCEPT: Applied to X = Col (i) and Y = Col (iii)

CORREL(Y-array, X-array) = CORREL(Col (iii), Col (i))		96.83%
m = slope = SLOPE(Y-array, X-array)		0.5048%
b = Y-intercept = INTERCEPT(Y-array, X-array) = INTERCEPT(Column(iii), Column(i))		-0.0194%
Average Advantage Change per True Count point (AACpTCp) = m * (51/52)		0.4951%
Full Deck House Advantage (FDHA), Infinite decks		0.5142%
Index (FDHA / AACpTCp)	*(Infinite Deck Assumption, or no recognition of any cards removed)*	1.04

Relationship between AACpTCp, Critical Indices, Correlation Coefficients and Standard Deviation
Infinite Deck Assumption

*AACpTCp = k1 * (CC / SD)*
Idx = Index
Idx = FDHA / AACpTCp
*Idx = k2 * (SD / CC)*

AACpTCp = k * (CC / SD)

AACpTCp2	=	k * (CC2 / SD2)
AACpTCp1	=	k * (CC1 / SD1)

*AACpTCp2 = AACpTCp1 * (CC2 / SD2) / (CC1 / SD1)*

Idx = k * (SD / CC)

Idx2	=	k * (SD2 / CC2)
Idx1	=	k * (SD1 / CC1)

*Idx2 = Idx1 * (SD2 / CC2) / (SD1 / CC1)*

EoR for betting, S17, DAS, no LS

Card	Y = Effect of Removal	X1 Hi-Low	X2 Red 7
Red 2	0.3809%	1	1
Black 2	0.3809%	1	1
Red 3	0.4339%	1	1
Black 3	0.4339%	1	1
Red 4	0.5680%	1	1
Black 4	0.5680%	1	1
Red 5	0.7274%	1	1
Black 5	0.7274%	1	1
Red 6	0.4118%	1	1
Black 6	0.4118%	1	1
Red 7	0.2823%	0	1
Black 7	0.2823%	0	0
Red 8	-0.0033%	0	0
Black 8	-0.0033%	0	0
Red 9	-0.1731%	0	0
Black 9	-0.1731%	0	0
Red 10	-0.5121%	-1	-1
Black 10	-0.5121%	-1	-1
Red J	-0.5121%	-1	-1
Black J	-0.5121%	-1	-1
Red Q	-0.5121%	-1	-1
Black Q	-0.5121%	-1	-1
Red K	-0.5121%	-1	-1
Black K	-0.5121%	-1	-1
Red A	-0.5794%	-1	-1
Black A	-0.5794%	-1	-1
Total (a)	0.0002%	0.0000	1.0000
mu = mean	0.0000%	0.0000	0.0385
STDEVP(X)		0.8771	0.8979
CORREL(Y,X)		96.48%	96.83%
SD / CC		0.9090	0.9273
SLOPE(Y,X)		0.515%	0.505%
AACpTCp = SLOPE(Y,X) * (51/52)		0.505%	0.495%
FDHA, inf. deck (Exhibit L4)		0.5142%	0.5142%
Index, inf. dk = FDHA / AACpTCp		1.02	1.04

(a) Sum(EoR) = 0. If not zero, error is due to rounding of each EoR to nearest 0.0001%.

Infinite Deck Assumption:

Proof: Index = FDHA / AACpTCp

x = X - mean (X) and y = Y - mean (Y)

AACpTCp = Slope of the LSL * (51/52) = Sum (x*y) / (Sum (x^2)) * (51/52)

CC = Correlation Coefficient = Sum (x*y) / SQRT (Sum (x^2) * Sum (y^2))

SD = Standard Deviation of the tag values of the Count X

= SQRT {var(X)} = SQRT {EV(X-uX)^2} = SQRT {EV(x^2)}

= SQRT {Sum (x^2) / n} where n = # of X values

(CC / SD) = [Sum (x*y) / SQRT (Sum (x^2) * Sum (y^2))] * [SQRT(n) / SQRT (Sum (x^2))]

= { SQRT(n) / SQRT (Sum (y^2) } * { Sum (x*y) / (Sum (x^2)) }

= { SQRT(n) / SQRT (Sum (y^2) } * [AACpTCp / (51/52)]

So AACpTCp = (51/52) * { SQRT(Sum (y^2)) / SQRT(n) } * (CC / SD)

Y = Effects of Removal, are constant for a given situation, so:

AACpTCp = k1 * (CC / SD)

AACpTCp is directly proportional to CC and inversely proportionally to SD.

Idx = FDHA / AACpTCp (infinite deck assumption):

Idx = k2 * (SD / CC)

Idx is directly proportional to SD and inversely proportionally to CC.

Y = EoR, X = count tag values, d = decks
AACpTCp = k1*(CC/SD)
Idx = FDHA / AACpTCp
so Idx = FDHA * { (1/ k1) * (SD/CC) }
and Idx = k2*(SD/CC)
where k2 = FDHA / k1

Term	Dimensions
AACpTCp	Y/(X/d) = Y*d / X
CC	Dimensionless
SD	X
FDHA	Y
k1	(Y*d/X)* X = Y*d
k2	Y / (Y*d) = 1/d
Idx	X / d

Betting		Hi-Low	Red 7	Ratios	
	Statistic	X1	X2	X2 / X1	
(1)	CC	96.48%	96.83%	1.004	
(2)	Std Dev	0.8771	0.8979	1.024	
(3)	AACpTCp	0.505%	0.495%	*0.980*	*AACpTCp2 / AACpTCp1*
(4)	CC / SD	1.100	1.078	*0.980*	*(CC2/SD2) / (CC1/SD1)*
(5)	Idx	1.0180	1.0385	*1.020*	*Idx2 / Idx1*
(6)	SD / CC	0.909	0.927	*1.020*	*(SD2/CC2) / (SD1/CC1)*

AACpTCp = k1 * (CC / SD) ***Idx = k2 * (SD / CC)***

SD:HL =	0.8771	SD:R7 =	0.8979

Special Cases
Infinite Deck Assumption

Equal Correlation Coefficients
Different Standard Deviations
EoR for betting, S17, DAS, no LS

Card	X1 Hi-Low Count	X2 = 2*X1 Count	Y Effect of Removal
2	1	2	0.3809%
3	1	2	0.4339%
4	1	2	0.5680%
5	1	2	0.7274%
6	1	2	0.4118%
7	0	0	0.2823%
8	0	0	-0.0033%
9	0	0	-0.1731%
10	-1	-2	-0.5121%
J	-1	-2	-0.5121%
Q	-1	-2	-0.5121%
K	-1	-2	-0.5121%
A	-1	-2	-0.5794%
Total (a)	0.0000	0.0000	0.0001%
mu = mean	0.0000	0.0000	0.0000%
STDEVP(X)	0.8771	1.7541	
CORREL(Y,X)	96.48%	96.48%	
SLOPE(Y,X)	0.515%	0.257%	
AACpTCp *	0.505%	0.253%	
FDHA, inf	0.5142%	0.5142%	
Index	1.02	2.04	

** AACpTCp = SLOPE(Y,X) * (51/52)*

(a) Sum(EoR) = 0. If not zero, error is due to rounding of each EoR to nearest 0.0001%.

	X1	X2	X2 / X1	
CC	0.9648	0.9648	1.0000	
SD	0.8771	1.7541	2.0000	
(SD/CC)	0.9090	1.8181	2.0000	*(SD2/CC2) / (SD1/CC1)*
Idx	1.0180	2.0361	2.0000	*Idx2 / Idx1*

*X2 = 2*X1 so CC2 = CC1 and Idx2 = 2*Idx1*

Exhibit K1: CC(aX + b, Y) = SIGN (a) * CC(X,Y)

Equal Standard Deviations
Different Correlation Coefficients
EoR for hard 16 v 7

Card	X1 Hi-Low Count	X2 Count	Y Effect of Removal
2	1	1	1.9267%
3	1	1	2.4386%
4	1	1	2.7835%
5	1	1	2.3262%
6	1	-1	-1.7981%
7	0	0	-2.1033%
8	0	0	-2.3217%
9	0	0	-2.7689%
10	-1	-1	-0.5915%
J	-1	-1	-0.5915%
Q	-1	-1	-0.5915%
K	-1	-1	-0.5915%
A	-1	1	1.8829%
Total (a)	0.0000	0.0000	-0.0001%
mu = mean	0.0000	0.0000	0.0000%
STDEVP(X)	0.8771	0.8771	
CORREL(Y,X)	37.06%	70.50%	
SLOPE(Y,X)	0.816%	1.552%	
AACpTCp *	0.800%	1.522%	
FDHA, inf	6.0599%	6.0599%	
Index	7.57	3.98	

** AACpTCp = SLOPE(Y,X) * (51/52)*

(a) Sum(EoR) = 0. If not zero, error is due to rounding of each EoR to nearest 0.0001%.

	X1	X2	X2 / X1	
CC	0.3706	0.7050	1.9022	
SD	0.8771	0.8771	1.0000	
(SD/CC)	2.3665	1.2441	0.5257	*(SD2/CC2) / (SD1/CC1)*
Idx	7.5720	3.9807	0.5257	*Idx2 / Idx1*

*SD2 = SD1 and CC2 = 1.9022 * CC1*
*So Idx2 = (1.0 / 1.9022) * Idx1 = 0.5257 * Idx1 = (CC1 / CC2) * Idx1*

Special Cases
Infinite Deck Assumption

Insurance

Card	X1 Hi-Low Count	X2 Gordon Count	Y Effect of Removal
2	1	1	1.8100%
3	1	1	1.8100%
4	1	1	1.8100%
5	1	1	1.8100%
6	1	0	1.8100%
7	0	0	1.8100%
8	0	0	1.8100%
9	0	0	1.8100%
10	-1	-1	-4.0724%
J	-1	-1	-4.0724%
Q	-1	-1	-4.0724%
K	-1	-1	-4.0724%
A	-1	0	1.8100%
Total (a)	0.0000	0.0000	1.8100%
mu = mean	0.0000	0.0000	0.0000%
STDEVP(X)	0.8771	0.7845	SD
CORREL(Y,X)	76.01%	84.98%	CC
SD / CC	1.1538	0.9231	SD / CC
SLOPE(Y,X)	2.353%	2.941%	
AACpTCp *	2.308%	2.885%	
FDHA, inf	7.6923%	7.6923%	
Index	3.33	2.67	

** AACpTCp = SLOPE(Y,X) * (51/52)*

Insurance

	Statistic	Hi-Low X1	Gordon X2	Ratios X2 / X1	
(1)	CC	76.01%	84.98%	1.118	
(2)	AACpTCp	2.308%	2.885%	*1.250*	AACpTCp2 / AACpTCp1
(3)	Std Dev	0.8771	0.7845	0.894	
(4)	CC / SD	0.867	1.083	*1.250*	(CC2 / SD2) / (CC1 / SD1)

AACpTCp = k * (CC / SD)

Insurance

	Statistic	Hi-Low X1	Gordon X2	Ratios X2 / X1	
(1)	CC	76.01%	84.98%	1.118	
(2)	Index	3.333	2.667	*0.800*	Index2 / Index1
(3)	Std Dev	0.8771	0.7845	0.894	
(4)	SD / CC	1.154	0.923	*0.800*	(SD2 / CC2) / (SD1 / CC1)

Idx = k * (SD / CC)

g = Gordon h = Hi-Low Idx = Index
Idx = k * (SD / CC)
Idx:g = Idx:h * (SD:g / CC:g) / (SD:h / CC:h)

Insurance Index for Gordon Count is less than Insurance Index for Hi-Low because:
(1) SD:g < SD:h Gordon counts less cards than the Hi-Low so has lower SD than Hi-Low.
(2) CC:g > CC:h Gordon has a higher insurance CC than the Hi-Low.

T,T v 5 split

Count	Hi-Low
Situation	TT v 5
k (# decks) =	infinite
Cor Coef	95.45%
AACpTCp	5.703%
FDHA, infinite	29.000%
MDHA=FDHA	n/a
MT = 0	n/a
YI = 0	n/a
Index, Idx	**5.09**

T,T v 5 split

Count	Red 7
Situation	TT v 5
k (# decks) =	infinite
Cor Coef	93.90%
AACpTCp	5.480%
FDHA, infinite	29.000%
MDHA=FDHA	n/a
MT = 0	n/a
YI = 0	n/a
Index, Idx	**5.29**

T,T v 5 split

	Statistic	Hi-Low X1	Red 7 X2	Ratios X2 / X1	
(1)	CC	95.45%	93.90%	0.984	
(2)	Index	5.085	5.292	*1.041*	Index2 / Index1
(3)	Std Dev	0.8771	0.8979	1.024	
(4)	SD / CC	0.919	0.956	*1.041*	(SD2 / CC2) / (SD1 / CC1)

Idx = k * (SD / CC)

hl = Hi-Low r7 = Red 7 Idx = Index
Idx = k * (SD / CC)
Idx:r7 = Idx:hl * (SD:r7 / CC:r7) / (SD:hl / CC:hl)

T,T v 5 split Index for Red 7 is greater than Hi-Low Index because:
(1) SD:r7 > SD:hl Red 7 counts more cards than the Hi-Low so Red 7 has higher SD than Hi-Low.
(2) CC:r7 < CC:hl Red 7 has a lower T,T v 5 split CC than the Hi-Low.

Infinite Deck Index under a Linear Transformation

Count T is a linear transformation of count X, so T= a*X + b
Idx(T) = Infinite deck count (T) index for a given playing strategy departure
Idx(X) = Infinite deck count (X) index for a given playing strategy departure

Then Idx(T) = Idx(a*X + b) = a * Idx(X)

From Exhibit K1:
CC(T,Y) = SIGN(a) * CC(X,Y)
where SIGN(a) = +1 if a > 0
SIGN(a) = -1 if a < 0 and SIGN(a) = 0 if a = 0

From Exhibit K2:
Idx = k2 * (SD / CC)
Idx is directly proportional to SD and inversely proportionally to CC.
(Idx2) / (Idx1) = (SD2/CC2) / (SD1/CC1)

Proof:
Idx(T) / Idx(X) = (SD(T) / CC(T)) / (SD(X) / CC(X))
SD(T) = SD(a*X + b), SD(T) = SQRT (Var(T))
Var(X) = E [(X - uX)^2] = E(X^2) - (uX)^2 where uX = mean(X)
Var(T) = E [(T - uT)^2] = E(T^2) - (uT)^2 where uT = mean(T)
T^2 = (a*X + b)^2 = a^2 * X^2 + 2*a*b *X + b^2
E(T^2) = a^2 * E(X^2) + 2*a*b*E(X) + b^2 where E(X) = mean(X) = uX
uT = E(T) = E(a*X + b) = a*E(X) + b where E(X) = mean(X) = uX
(uT)^2 = (a*(uX) + b)^2 = a^2 * (uX)^2 + 2*a*b*(uX) + b^2
Var(T) = E(T^2) - (uT)^2 = a^2 * [E(X^2) - (uX)^2] = a^2 * Var(X)
SD(T) = Sqrt(a^2) * SD(X) = AV(a) * SD(X) where AV = Absolute Value

Idx(T) / Idx(X) = (SD(T) / CC(T)) / (SD(X) / CC(X))
SD(T) / CC(T) = [AV(a) * SD(X)] / [SIGN(a) * CC(X)]
SD(T) / CC(T) = [AV(a) / SIGN(a)] * [SD(X) / CC(X)]
(SD(T) / CC(T)) = a * (SD(X) / CC(X))
(SD(T) / CC(T)) / (SD(X) / CC(X)) = a
Idx(T) / Idx(X) = a
Idx(T) = a * Idx(X)

Infinite Deck Index under a Linear Transformation

Some Examples — **Idx(a*X + b) = a * Idx(X)**

Linear Transformation T = a*X + b		a =	0.500	-2.000	2.500	-3.500	4.000
EoR for betting, S17, DAS, no LS	Y	b =	1.250	0.500	-3.250	-2.750	0.000
	Effect of	**X**	T1	T2	T3	T4	T5
Card	Removal	Count	T = a*X + b	T = a*X + b	T = a*X + b	T = a*X + b	T = a*X + b
2	0.3809%	1	1.75	-1.5	-0.75	-6.25	4
3	0.4339%	1	1.75	-1.5	-0.75	-6.25	4
4	0.5680%	1	1.75	-1.5	-0.75	-6.25	4
5	0.7274%	1	1.75	-1.5	-0.75	-6.25	4
6	0.4118%	1	1.75	-1.5	-0.75	-6.25	4
7	0.2823%	0	1.25	0.5	-3.25	-2.75	0
8	-0.0033%	0	1.25	0.5	-3.25	-2.75	0
9	-0.1731%	0	1.25	0.5	-3.25	-2.75	0
10	-0.5121%	-1	0.75	2.5	-5.75	0.75	-4
J	-0.5121%	-1	0.75	2.5	-5.75	0.75	-4
Q	-0.5121%	-1	0.75	2.5	-5.75	0.75	-4
K	-0.5121%	-1	0.75	2.5	-5.75	0.75	-4
A	-0.5794%	-1	0.75	2.5	-5.75	0.75	-4
Total	0.0001%	0.0000	16.2500	6.5000	-42.2500	-35.7500	0.0000
mu = mean	0.0000%	0.0000	1.2500	0.5000	-3.2500	-2.7500	0.0000
SD = STDEVP(X-array)	n/a	0.8771	0.4385	1.7541	2.1926	3.0697	3.5082
CC = CORREL(Y-array, X-array)	n/a	0.9648	0.9648	-0.9648	0.9648	-0.9648	0.9648
(SD/CC)	n/a	0.9090	0.4545	-1.8181	2.2726	-3.1817	3.6362
m = SLOPE(Y-array, X-array)	n/a	0.5150%	1.0300%	-0.2575%	0.2060%	-0.1471%	0.1287%
AACpTCp = m * (51/52)	n/a	0.5051%	1.0102%	-0.2525%	0.2020%	-0.1443%	0.1263%
FDHA, inf dks	n/a	0.5142%	0.5142%	0.5142%	0.5142%	0.5142%	0.5142%
Index (FDHA / AACpTCp)	n/a	1.02	0.51	-2.04	2.55	-3.56	4.07
u = unbalance per deck = Total * 4 = mean * 52	n/a	0.0	65.0	26.0	-169.0	-143.0	0.0

Effect of Removal Definition

EV(X) = Sum (x * f(x)),

EV(X) = player's expected value of random variable X under consideration.

x = value of variable X being measured

f(x) = probability that X = x, i.e. f(x) = Prob(X=x)

EoR(c) = Effect of Removal of card "c" from a full deck.

EoR(c) = EV(51 cards remaining after removal of card "c") - EV(Full 52 cards)

Insurance

Card	EoR	Frequency	Total
Non Ten	1.810%	36	65.158%
Ten	-4.072%	16	-65.158%
Total	n/a	52	0.000%

Sum (EoR for a full deck) = 0

Exact Insurance Values

FDHA	=	-(1/13)	~=	7.69231%
EoR(Non-Ten)	=	(4/221)	~=	1.80995%
EoR(Ten)	=	-(9/221)	~=	-4.07240%

Example:

X = amount of units won by player from a one unit insurance bet.

ddc = Dealer Down Card

Insurance 52 cards: full deck

X	comment	x	f(x) (comment)	f(x)	x*f(x)
Dealer BJ	ddc = T	2	(16/52)	0.3077	0.6154
No Dealer BJ	ddc = non-T	-1	(36/52)	0.6923	-0.6923
Total		n/a	1.0000	1.0000	-7.692%

EV(X, 52 cards) = (-1)*(4/52) = (-1)*(1/13)

Insurance 52 cards: full deck

X	comment	x	f(x) (comment)	f(x)	x*f(x)
Dealer BJ	ddc = T	2	(16/52)	0.3077	0.6154
No Dealer BJ	ddc = non-T	-1	(36/52)	0.6923	-0.6923
Total		n/a	1.0000	1.0000	-7.692%

EV(X, 52 cards) = (-1)*(4/52) = (-1)*(1/13)

Insurance Removal of *Ace* : 51 cards remaining

X	comment	x	f(x) (comment)	f(x)	x*f(x)
Dealer BJ	ddc = T	2	(16/51)	0.3137	0.6275
No Dealer BJ	ddc = non-T	-1	(35/51)	0.6863	-0.6863
Total		n/a	1.0000	1.0000	-5.882%

EV(X, 51 cards: Ace removed) = (-1)*(3/51)

EoR(Ace) = EV(51 cards: *Ace* removed) - EV(52 cards) = 1.810%

Insurance Removal of *Ten* : 51 cards remaining

X	comment	x	f(x) (comment)	f(x)	x*f(x)
Dealer BJ	ddc = T	2	(15/51)	0.2941	0.5882
No Dealer BJ	ddc = non-T	-1	(36/51)	0.7059	-0.7059
Total		n/a	1.0000	1.0000	-11.765%

EV(X, 51 cards: Ten removed) = (-1)*(6/51)

EoR(Ten) = EV(51 cards: Ten removed) - EV(52 cards) = -4.072%

Insurance Removal of 2 Non-Tens, 1 Ten: 49 cards remaining

X	comment	x	f(x) (comment)	f(x)	x*f(x)
Dealer BJ	ddc = T	2	(15/49)	0.3061	0.6122
No Dealer BJ	ddc = non-T	-1	(34/49)	0.6939	-0.6939
Total		n/a	1.0000	1.0000	-8.163%

EV(X, 49 cards: 2 Non-Tens, 1 Ten removed)

Change EV

= EV(X, 49 cards: 2 Non-Tens, 1 Ten removed) - EV(52 cards) = -0.471%

Change EV (single deck)

= Sum(EoR of "n" cards removed) * (51/(cards remaining))

= Sum(EoR of "n" cards removed) * (51/(52 - n)), n = # cards removed

Change EV from removal of 2 Non-Tens, 1 Ten

= Sum[EoR(non-T) + EoR(non-T) + EoR(T)] * (51/49)

= Sum[1.810% + 1.810% + (-4.072%)] * (51/49)

= -0.470%

*In general, for "k" decks and "n" cards removed: [cards remaining = (52*k - n)]*

Change EV = Sum [EoR(cards removed)] * [51 / (52*k - n)]

Note: For k = 1, n = 1, Change EV = EoR(card removed)

Effect of Removal Definition

Proof for Insurance, 2 non-Tens, 1 Ten removed:

To Show: Change EV(2 non-Tens, 1 Ten removed)
= (51/49) * Sum (EoR cards removed)
= (51/49) * [2*EoR(non-Ten) + EoR(Ten)]

Change EV(2 non-Tens, 1 Ten removed) = (1/49) * [2*15 - 1*34] - EV(52 cards)
EoR(non-Ten) = (1/51) * [2*16 - 1*35] - EV(52 cards)
EoR(Ten) = (1/51) * [2*15 - 1*36] - EV(52 cards)
EV(52 cards) = (1/52) * [2*16 - 1*36]

2* EoR(non-T) = (2/51) * [2*16 - 1*35] - 2*EV(52 cards)
EoR(Ten) = (1/51) * [2*15 - 1*36] - EV(52 cards)
Sum(EoR) = (1/51) * [4*16 - 2*35 + 2*15 - 36] - 3*EV(52 cards)

(51/49) * Sum(EoR) = (1/49) * [4*16 - 2*35 + 2*15 - 36] - 3*(51/49)*EV(52 cards)
Change EV(2 non-T, 1 T removed) = (1/49) * [2*15 - 1*34] - EV(52 cards)

Need to show:
(1/49) * [2*15 - 1*34] - EV(52 cards) ?=? (1/49) * [4*16 - 2*35 + 2*15 - 36] - 3*(51/49)*EV(52 cards)
[2*15 - 1*34] - 49 * EV(52 cards) ?=? [4*16 - 2*35 + 2*15 - 36] - 3*(51)*EV(52 cards)
-4 - 49*EV(52 cards) ?=? -12 - 3*(51)*EV(52 cards)
EV(52 cards) * (-49 + 3*51) ?=? -12 + 4
EV(52 cards) * 104 ?=? -8
EV(52 cards) ?=? -8/104
EV(52 cards) = -1/13 = -7.692%

Perfect Insurance Counts

	(Infinite Deck Assumption)		Balanced	
	Unbalanced		k =	**4.33333**
Card	X1 Count	Effect of Removal	X2 = X1 - uX1	X3 = k * X2
2	1	4/221	0.92308	4.0000
3	1	4/221	0.92308	4.0000
4	1	4/221	0.92308	4.0000
5	1	4/221	0.92308	4.0000
6	1	4/221	0.92308	4.0000
7	1	4/221	0.92308	4.0000
8	1	4/221	0.92308	4.0000
9	1	4/221	0.92308	4.0000
10	-2	- 9/221	-2.07692	-9.0000
J	-2	- 9/221	-2.07692	-9.0000
Q	-2	- 9/221	-2.07692	-9.0000
K	-2	- 9/221	-2.07692	-9.0000
A	1	4/221	0.92308	4.0000
Total	1.0000	0.0000%	0.00000	0.0000
mu = mean	0.0769	0.0000%	0.00000	0.0000
unbal / dk = u = mu*52	4.0000	0.0000%	0.00000	0.0000
CC = CORREL(Y-array, X-array)		100.00%		100.00%
m = slope = SLOPE(Y-array, X-array)		1.961%		0.452%
AACpTCp = m * (51/52)		1.923%		0.444%
Full Dk House Adv (FDHA), infinite dks		7.692%		7.692%
Index (FDHA / AACpTCp), inf dks		***4.00***		***17.33***

Pivot Point of X1 is true count of 4 or running count of 4*n

Insure if unbalanced X1 Running Count >= 4*n, n = number or decks

Full Deck House Advantage and Player Advantage Definitions

Definition of Full Deck House Advantage (FDHA)

EoR for a given situation is actually the difference of the EoR for two strategic decisions to be made. For betting, over/under and insurance the actual EoR is used, but for other strategic situations, the difference in EoR are used. For a given hit/stand decision, the entries in the EoR table are actually delta EoR, i.e. EoR for hit less EoR for standing.
The "m8" entry for hard 12 v 2, for example, is 4.007% which is the difference of the expected value of hitting less the expected value of standing for a full eight decks.
So hitting hard 12 v 2 is 4.007% better than standing on hard 12 v 2 for a full eight decks. Or put differently, the FDHA for eight decks is 4.007% which means that the full deck house advantage of standing over hitting is 4.007%, i.e. the house has an additional 4.007% advantage over the player if the player stands instead of hitting hard 12 v 2 from the full deck composition. For hard 12 v 2 hit/stand decision the EoR of a "6" for example, is -1.6312% and this is calculated as follows: EoR(6) hit - EoR(6) stand = -1.6312%. This means that if a "6" is removed from a full deck, the advantage of hitting over standing decreases by 1.6321% or equivalently the advantage of standing over hitting increases 1.6312%. As stated above the FDHA for eight decks is 4.007% which means that the full deck house advantage of standing over hitting is 4.007%, i.e. the house has an additional 4.007% advantage over the player if the player stands instead of hitting hard 12 v 2 from the full deck composition. If EoR signs are reversed so that stand less hit EoR are used then the Correlation Coefficient and AACpTCp of the tag values of the Red 7 count and the stand less hit EoR for hard 12 v 2 are positive. So as the count increases, the player's advantage of standing over hitting increases (i.e. the FDHA of standing over hitting decreases) until it is finally better for the player to stand rather than to hit when the true count is greater than the index.
The player initially starts out with a stand less hit player's advantage of (-4.007%) but as the Red 7 true count increases, stand less hit increases until eventually stand less hit expectation is zero when true count is equal to the Index and greater than zero when true count greater than Index so stand when the true count is greater than the Index.

Definition of Player's Advantage at true count "t", pa(t)

Player's advantage at true count "t", pa(t), is the actual player's advantage for betting, insurance and the over/under bet since actual EoR (not the difference in EoR of two decisions) are used. For other situations, EoR and FDHA label that is used, is really the difference of the EoR and FDHA for the two choices being considered, such as hitting versus standing. So pa(t) for these cases is also the difference in player's expectation for the two choices being considered at true count "t". Fore example, in the situation shown below, Red 7, h12 v 2, eight decks, the two decisions being tested are hitting versus standing and it is seen that at t=0, pa(0) = -4.15% which means that the player is -4.15% worse off ("house advantage") if the player stands as opposed to hitting, but at t=4, pa(4) = 0.95% and the player is 0.95% better off standing as opposed to hitting at Red 7 true count of 4. ***So pa(t) for h12 v 2 is the player's advantage of standing over hitting.***

Slope = AACpTCp and pa(t) goes through (Idx,0), i.e. pa(Idx) = 0 **pa(t) = AACpTCp * (t - Idx)**

Count	Red 7
Situation	h12 v 2
k (# decks) =	8
Cor Coef	66.83%
AACpTCp	1.274%
FDHA,"k" dks	4.007%
MDHA,"k" dks	3.993%
MT, "k" dks	0.125
YI, "k" decks	(0.0048)
Prop Defl Idx	**3.25**

pa(t) ~= AACpTCp * (t - Idx)

k (# decks) =	8
Red 7	h12 v 2
t	pa(t)
0	-4.15%
1	-2.87%
2	-1.60%
3	-0.32%
4	0.95%
5	2.22%
6	3.50%

Full Deck House Advantage and Player Advantage Definitions

Calculation of Player's Advantage

pa(t) = Player's Advantage at True Count "t"

pa(t) = AACpTCp * (t - MT - YI) + EoR:(n,k) - FDHA
= AACpTCp * (t - MT - YI) - (FDHA - EoR:(n,k))
= AACpTCp * (t - MT - YI) - MDHA
MDHA = FDHA - EoR(n,k)
EoR:(n,k) = EoR of "n" cards removed from "k" decks = Sum { EoR(puc1, puc2, duc) } * [51 / (52*k - n)]
MT = Modified Tagged value = (Sum Tags Removed)* [52 / (52*k - n)]
YI = (-1) * u * { n / (52*k - n) } where u = unbalance per deck, n = # cards out, k = # decks

pa(t) = AACpTCp * (t - MT - YI) - MDHA

Count	Red 7
Situation	Insurance
k (# decks) =	6
Cor Coef	77.57%
AACpTCp	2.304%
FDHA,"k" dks	7.692%
MDHA,"k" dks	7.395%
MT, "k" dks	(0.167)
YI, "k" decks	(0.0064)
Prop Defl Idx	**3.0365**

Example: 6 deck insurance, duc = A, Red 7 count

rc =	-1	(duc = A)
cr =	311	cards remaining
dr = cr / 52	5.981	decks remaining
tc =	-0.1736	tc = 2 + (rc - 12)/dr
Sum Tags Removed	-1	(duc = A)
n =	1	number of cards removed
k =	6	number of decks
MT =	-0.1672	MT = Modified Tagged value = (Sum Tags Removed)* [52 / (52*k - n)]
EoR:(Ace, 6 decks) =	0.2968%	EoR('Ace, k decks) = EoR(Ace,1 deck) } * [51 / (52*k - n)], EoR(Ace, 1 deck) = 1.8100%
FDHA =	7.6923%	
MDHA =	7.3955%	MDHA = FDHA - EoR(n,k)
u =	2	Red 7 unbalance per deck
YI =	-0.0064	YI = (-1) * u * { n / (52*k - n) } where u = unbalance per deck, n = # cards out, k = # decks
AACpTCp =	2.3038%	Calculated from either LSL (Exhibit 2) or PD (Exhibit 4) for Red 7 insurance with Ace removed

Full Deck House Advantage and Player Advantage Definitions

Calculation of Player's Advantage (continued)

Example: 6 deck insurance, duc = A, Red 7 count

So using the above formula for the Red 7 count with just the Ace out of a six deck game, player's advantage is:

pa(t) = AACpTCp * (t - MT - YI) - MDHA

t =	-0.1736
MT =	-0.1672
YI =	-0.0064
t - MT - YI =	0.0000
AACpTCp	2.3038%
AACpTCp * (t - MT - YI) =	0.0000%
MDHA =	7.3955%
pa(t) =	-7.3955%

pa(t) = AACpTCp * (t - Idx)

t =	-0.1736
Idx =	3.0365
AACpTCp =	2.3038%
pa(t) =	-7.3955%

So in this case with just the Ace removed from a Six deck game, the player's advantage should be (-1)*MDHA
With just the Ace removed, the Red 7 running count is -1 so the Red 7 true count is -0.1736 and pa(-0.1736) = (-1)*MDHA
So this formula gives the correct player's advantage for this given situation.

pa(t) = AACpTCp * (t - MT - YI) - MDHA
Idx = (MDHA / AACpTCp) + MT + YI

So it is easy to prove from the above formulas:

pa(t) = AACpTCp * (t - Idx)

pa(t) = AACpTCp * (t - Idx)
= AACpTCp * t - AACpTCp * Idx
= AACpTCp * t - { MDHA + AACpTCp * [MT + YI] }
= AACpTCp * (t - MT - YI) - MDHA

Full Deck House Advantage and Player Advantage Definitions

The Infinite Deck Approximation used in the calculation of AACpTCp and the non-recognition of the removal of the dealer's and player's up cards are calculated and shown to be used as a comparison with the more correct approach here where the AACpTCp is calculated for the depleted deck and the removal of the dealer's and player's up cards are taken into account in the calculations of AACpTCp, the Modified Deck House Advantage (MDHA) and Modified Tag (MT) and the Y-Intercept (YI) which is an adjustment necessary for unbalanced counts. All of these terms are used in the calculation of the Index. The majority of the time, these two calculations are in close agreement. Below are a few situations where there was a large differences in the Index as the number of decks varies.

Red 7

Examples of large variations of indices as the number of decks varies

		1 deck	2 deck	6 deck	8 deck	Infinite
Insurance	Corr Coef	80.02%	78.53%	77.57%	77.46%	77.10%
	AACpTCp	2.394%	2.339%	2.304%	2.299%	2.287%
	Index	1.40	2.38	3.04	3.12	3.36
2,2 v 8 DAS	Corr Coef	19.79%	20.36%	20.75%	20.80%	20.94%
	AACpTCp	0.435%	0.455%	0.469%	0.471%	0.476%
	Index	10.37	6.81	4.66	4.40	3.65
7,7 v 8 DAS	Corr Coef	28.74%	29.21%	29.50%	29.54%	29.65%
	AACpTCp	0.459%	0.484%	0.501%	0.503%	0.508%
	Index	-4.78	-0.09	2.66	2.99	3.95
2,2 v 3,	Corr Coef	12.25%	12.57%	12.77%	12.79%	12.86%
NDAS, H17	AACpTCp	0.200%	0.201%	0.202%	0.202%	0.202%
	Index	-2.83	4.25	8.80	9.37	11.05

LSL Fit between Red 7 & Hi-Low and Red 7 & KO running counts

Card	Y Red 7 Count	X1 Hi-Low Count	X2 KO Count
Red 2	1	1	1
Black 2	1	1	1
Red 3	1	1	1
Black 3	1	1	1
Red 4	1	1	1
Black 4	1	1	1
Red 5	1	1	1
Black 5	1	1	1
Red 6	1	1	1
Black 6	1	1	1
Red 7	1	0	1
Black 7	0	0	1
Red 8	0	0	0
Black 8	0	0	0
Red 9	0	0	0
Black 9	0	0	0
Red 10	-1	-1	-1
Black 10	-1	-1	-1
Red J	-1	-1	-1
Black J	-1	-1	-1
Red Q	-1	-1	-1
Black Q	-1	-1	-1
Red K	-1	-1	-1
Black K	-1	-1	-1
Red A	-1	-1	-1
Black A	-1	-1	-1
Total	1.0000	0.0000	2.0000
STDEVP	0.8979	0.8771	0.9166
SD(Y)/SD(X)	1.0000	1.0238	0.9795
CC = CORREL(Y,X)		97.68%	97.77%
slope = SLOPE(Y,X) = m		1.0000	0.9577
Y-Int = Intercept(Y,X) = b		0.0385	-0.0352
mu = mean	0.0385	0.0000	0.0769
unbalance / dk	2.0000	0.0000	4.0000

mu = mean = unbalance per card
u = unbalance per deck = 52 * mu

u = unbalance per deck = 52*mu where mu = mean = unbalance per card
cp = cards played = 52*dp where cp = cards played and dp = decks played
(mu)*(cp) = unbalance in running count when "cp" cards are played.
u*dp = unbalance in running count when "dp" decks played
(mu)*(cp) = (u/52)*(52*dp) = u*(dp)

Red 7 and Hi-Low

Fit LSL to X1 and Y:
Y = Red 7 X1 = Hi-Low
m = Slope of LSL = 1.000
Y = m*X1 + j*(dp)
where "j" is calculated so that
EV(Y) = m*EV(X1) + j*dp
If dp = 1, then using Expected Values,
Y = Red 7 = 2 and X1 = Hi-Low = 0
2 = m*(0) + k*(1), so k = 2.
Red 7 ~= Hi-Low + 2*dp
Correlation Coefficient = 97.68%

rc.r7 = Red 7 running count
rc.hl = Hi-Low running count
tc = true count
r7p = Red 7's played
rc.r7 = rc.hl + r7p
Using expected values and dp decks played
rc.r7 = rc.hl + 2*dp
tc = rc.hl / dr
tc = (rc.r7 - 2*dp) / dr
using dp = (n - dr):
tc = 2 + (rc.r7 - 2*n) / dr

Red 7 and KO

Fit LSL to X2 and Y:
Y = Red 7 X2 = KO
m = Slope of LSL = 0.958
Y = m*X2 + j*(dp)
where "j" is calculated so that
EV(Y) = m*EV(X2) + j*dp
If dp = 1, then using Expected Values,
Y = Red 7 = 2 and X2 = KO = 4
2 = m*(4) + j*(1), so j = 2 - 4*m = -1.831
Red 7 ~= 0.958*KO - 1.831*dp
Correlation Coefficient = 97.77%
The LSL fit of KO to Red 7 differs somewhat from the expected
Red 7 = KO - 2*dp
In both cases if dp = 1 and KO = EV(KO) = 4 then Red 7 = EV(R7) = 2
but Red 7 = 0.958*KO - 1.831*dp is the LSL fit and Red = KO - 2*dp is not.

LSL Test between Red 7 & Hi-Low and Red 7 & KO running counts

LSL Est.	Est. #1	**Red 7 ~= Hi-Low + 2*dp**	CC(R7,HL) =	97.68%
NOT LSL	Est. #2	**Red 7 ~= KO - 2*dp**	CC(R7,KO) =	97.77%
LSL Est.	Est. #3	**Red 7 ~= 0.958*KO - 1.831*dp**	CC(R7,KO) =	97.77%

			Incremental			Cumulative			Cumulative Est.'s and Actual Red 7				Absolute Value (Est. - Actual)		
Card	Cards Played cp	Decks Played dp = cp/52	Red 7	Hi-Low	KO	Red 7	Hi-Low	KO	Hi-Low + 2*dp	KO - 2*dp	0.958*KO - 1.831*dp	Red 7 Actual	Hi-Low + 2*dp	KO - 2*dp	0.958*KO - 1.831*dp
Red-3	1	0.0192	1	1	1	1	1	1	1.04	0.96	0.92	1	0.04	0.04	0.08
Red-A	2	0.0385	-1	-1	-1	0	0	0	0.08	-0.08	-0.07	0	0.08	0.08	0.07
Red-K	3	0.0577	-1	-1	-1	-1	-1	-1	-0.88	-1.12	-1.06	-1	0.12	0.12	0.06
Black-A	4	0.0769	-1	-1	-1	-2	-2	-2	-1.85	-2.15	-2.06	-2	0.15	0.15	0.06
Red-9	5	0.0962	0	0	0	-2	-2	-2	-1.81	-2.19	-2.09	-2	0.19	0.19	0.09
Red-8	6	0.1154	0	0	0	-2	-2	-2	-1.77	-2.23	-2.13	-2	0.23	0.23	0.13
Red-5	7	0.1346	1	1	1	-1	-1	-1	-0.73	-1.27	-1.20	-1	0.27	0.27	0.20
Black-K	8	0.1538	-1	-1	-1	-2	-2	-2	-1.69	-2.31	-2.20	-2	0.31	0.31	0.20
Black-9	9	0.1731	0	0	0	-2	-2	-2	-1.65	-2.35	-2.23	-2	0.35	0.35	0.23
Red-6	10	0.1923	1	1	1	-1	-1	-1	-0.62	-1.38	-1.31	-1	0.38	0.38	0.31
Red-4	11	0.2115	1	1	1	0	0	0	0.42	-0.42	-0.39	0	0.42	0.42	0.39
Black-8	12	0.2308	0	0	0	0	0	0	0.46	-0.46	-0.42	0	0.46	0.46	0.42
Black-J	13	0.2500	-1	-1	-1	-1	-1	-1	-0.50	-1.50	-1.42	-1	0.50	0.50	0.42
Red-7	14	0.2692	1	0	1	0	-1	0	-0.46	-0.54	-0.49	0	0.46	0.54	0.49
Black-6	15	0.2885	1	1	1	1	0	1	0.58	0.42	0.43	1	0.42	0.58	0.57
Red-2	16	0.3077	1	1	1	2	1	2	1.62	1.38	1.35	2	0.38	0.62	0.65
Red-J	17	0.3269	-1	-1	-1	1	0	1	0.65	0.35	0.36	1	0.35	0.65	0.64
Black-2	18	0.3462	1	1	1	2	1	2	1.69	1.31	1.28	2	0.31	0.69	0.72
Black-10	19	0.3654	-1	-1	-1	1	0	1	0.73	0.27	0.29	1	0.27	0.73	0.71
Black-3	20	0.3846	1	1	1	2	1	2	1.77	1.23	1.21	2	0.23	0.77	0.79
Black-Q	21	0.4038	-1	-1	-1	1	0	1	0.81	0.19	0.22	1	0.19	0.81	0.78
Red-Q	22	0.4231	-1	-1	-1	0	-1	0	-0.15	-0.85	-0.77	0	0.15	0.85	0.77
Black-7	23	0.4423	0	0	1	0	-1	1	-0.12	0.12	0.15	0	0.12	0.12	0.15
Black-4	24	0.4615	1	1	1	1	0	2	0.92	1.08	1.07	1	0.08	0.08	0.07
Red-10	25	0.4808	-1	-1	-1	0	-1	1	-0.04	0.04	0.08	0	0.04	0.04	0.08
Black-5	26	0.5000	1	1	1	1	0	2	1.00	1.00	1.00	1	0.00	0.00	0.00
												Average	0.25	0.38	0.35

Notes:

Cards shuffled in Exhibit K7d - Half Deck Shuffling and incremental count values looked up in Exhibit K10a - Count Table

Average Absolute Value (estimated Red 7 - actual Red 7) varies by the particular permutation of the 26 cards shown above.

For the permutations of 26 cards tested:

Estimate #1 is a LSL estimate of the Red 7 and Hi-Low
which has a Correlation Coefficient of 97.68%
and has an Average Absolute Value of difference of estimated and actual of 0.32.

Estimate #2 is NOT a LSL estimate of the Red 7 and KO
and has an Average Absolute Value of difference of estimated and actual of 0.35.

Estimate #3 is a LSL estimate of the Red 7 and KO
which has a Correlation Coefficient of 97.77%
and Average Absolute Value of difference of estimated and actual of 0.35

All three estimates have small errors and estimate Red 7 fairly well with large CC that are essentially equal.

Square of the errors is really what LSL minimizes. Absolute Value of errors calculated for illustration.

Trial #	Est #1	Est #2	Est #3
1	0.26	0.25	0.22
2	0.36	0.31	0.25
3	0.33	0.48	0.54
4	0.41	0.25	0.24
5	0.29	0.36	0.28
6	0.31	0.41	0.50
7	0.36	0.48	0.54
8	0.28	0.27	0.29
9	0.36	0.26	0.25
10	0.25	0.38	0.35
Average	0.32	0.35	0.35

Count Table

ount Table: must be sorted by Card for Table looku

Card	Red 7	Hi-Low	KO
Red-2	1	1	1
Black-2	1	1	1
Red-3	1	1	1
Black-3	1	1	1
Red-4	1	1	1
Black-4	1	1	1
Red-5	1	1	1
Black-5	1	1	1
Red-6	1	1	1
Black-6	1	1	1
Red-7	1	0	1
Black-7	0	0	1
Red-8	0	0	0
Black-8	0	0	0
Red-9	0	0	0
Black-9	0	0	0
Red-10	-1	-1	-1
Black-10	-1	-1	-1
Red-J	-1	-1	-1
Black-J	-1	-1	-1
Red-Q	-1	-1	-1
Black-Q	-1	-1	-1
Red-K	-1	-1	-1
Black-K	-1	-1	-1
Red-A	-1	-1	-1
Black-A	-1	-1	-1

Count Table: sorted by "Card" for Table lookup

Card	Red 7	Hi-Low	KO
Black-10	-1	-1	-1
Black-2	1	1	1
Black-3	1	1	1
Black-4	1	1	1
Black-5	1	1	1
Black-6	1	1	1
Black-7	0	0	1
Black-8	0	0	0
Black-9	0	0	0
Black-A	-1	-1	-1
Black-J	-1	-1	-1
Black-K	-1	-1	-1
Black-Q	-1	-1	-1
Red-10	-1	-1	-1
Red-2	1	1	1
Red-3	1	1	1
Red-4	1	1	1
Red-5	1	1	1
Red-6	1	1	1
Red-7	1	0	1
Red-8	0	0	0
Red-9	0	0	0
Red-A	-1	-1	-1
Red-J	-1	-1	-1
Red-K	-1	-1	-1
Red-Q	-1	-1	-1

Shuffling Table - Half Deck (26 cards)

Unshuffled

Card Number	Card
1	Red-2
2	Black-2
3	Red-3
4	Black-3
5	Red-4
6	Black-4
7	Red-5
8	Black-5
9	Red-6
10	Black-6
11	Red-7
12	Black-7
13	Red-8
14	Black-8
15	Red-9
16	Black-9
17	Red-10
18	Black-10
19	Red-J
20	Black-J
21	Red-Q
22	Black-Q
23	Red-K
24	Black-K
25	Red-A
26	Black-A
351	check total

Original Card Number	RANDBETWEEN(1,1000)	Original Sorted by Randbetween
1	191	3
2	978	25
3	720	23
4	134	26
5	578	15
6	80	13
7	391	7
8	643	24
9	271	16
10	10	9
11	869	5
12	333	14
13	514	20
14	18	11
15	40	10
16	366	1
17	300	19
18	682	2
19	946	18
20	915	4
21	779	22
22	497	21
23	673	12
24	6	6
25	808	17
26	532	8
351	check total	351

Shuffled

Number	Card
3	Red-3
25	Red-A
23	Red-K
26	Black-A
15	Red-9
13	Red-8
7	Red-5
24	Black-K
16	Black-9
9	Red-6
5	Red-4
14	Black-8
20	Black-J
11	Red-7
10	Black-6
1	Red-2
19	Red-J
2	Black-2
18	Black-10
4	Black-3
22	Black-Q
21	Red-Q
12	Black-7
6	Black-4
17	Red-10
8	Black-5
351	check total

Generalized True Count

If tc = true count, rc = running count, u = unbalanced count per deck,
n = number of decks, dr = decks remaining, dp = decks played then:

tc = u + (rc - u*n) / dr = (rc - u*dp) / dr
If src = shifted running count = (rc - u*n) then tc = u + (src) / dr

tc = u + (rc - u*n) / dr. n = # decks = (dp + dr) and so tc = (rc - u*dp)/dr.
Note: u*dp = expected unbalance when "dp" decks are played
so (rc - u*dp) = expected equivalent balanced running count.

rc = u*n + (tc - u)*dr = tc*dr + u*dp
If src = shifted running count = (rc - u*n) then src = (tc - u)*dr

Index = (MDHA/AACpTCp) + (T - u*dp)/dr

where MDHA = FHDA - EoR(cp,n)
MDHA = modified deck hour advantage,
FHDA = full deck house advantage,
EoR = Effects of Removal,
cp = cards played,
n = number of decks,
cr = cards remaining = (52*n - cp)

EoR(cp,n) = Sum { EoR(puc1, puc2, duc) } * [51 / (cr)] =
Sum { EoR(puc1, puc2, duc) } * [51 / (52*n - cp)]
puc1 = player's up card #1,
puc2 = player's up card #2,
duc = dealer's up card

AACpTCp = {(Slope of LSL(EoR,X)}*(51/52) where X = tag values of count
(T - u*(dp)) / dr = total true count Index adjustment for tags removed
T = Sum { Tagged value of removed cards: (puc1, puc2, duc) },
u = unbalance per deck,
dp = decks played = (cp / 52),
dr = decks remaining = (n - dp) = (cr / 52),
n = number of decks = (dp + dr)

Running Count in terms of Decks Played

Goal: Express Running count in terms of Decks Played
Given: rc = u*n + (tc - u)*dr and dr = (n - dp)
Find: (rc) in terms of (dp)

rc = u*n + (tc - u)*dr = u*n + (tc - u)*(n - dp) = (u - tc)*dp + n*tc
rc = (u - tc)*dp + n*tc

Note #1: For a balanced count, u = 0 and above formula degenerates to
rc = (0 - tc)*dp + n*tc = tc*(n - dp) = tc*dr which is tc = (rc/dr)

Note #2: For true count of zero, tc = 0 and above formula degenerates to rc = u*dp

rc = u*n + (tc - u)*dr
rc = u*dp + tc*dr
rc = (u - tc)*dp + n*tc
src = shifted running count = (rc - u*n) so src = (tc - u)*dr

True Count of Zero corresponds to rc = u*dp

Stand on Hard 16 v T if tc:{Red)} >= 0
Stand on Hard 12 v 4 if tc:{Red)} >= 0
Red 7 has an unbalance of 2 per deck, i.e. u = 2.
A true count of zero corresponds to an unbalanced running count of u*dp
So a true count of zero for Red 7 corresponds to 2*dp
Stand on Hard 16 v T if Red 7 >= 2*dp
Stand on Hard 12 v 4 if Red 7 >= 2*dp

Generalized Running Count Formulas

rc = u*n + (tc - u)*dr
rc = u*dp + tc*dr
rc = (u - tc)*dp + n*tc
src = shifted running count = (rc - u*n) so src = (tc - u)*dr

Red 7, Six decks

u = 2, n = 6:
rc = (2 - tc)*dp + 6*tc
rc = 2*dp + tc*dr
rc = 12 + (tc - 2)*dr
src = rc - 12
src = (tc - 2)*dr

Red 7, Six decks

tc	rc	rc	rc	src
5	-	-	12 + 3*dr	3*dr
4	-	-	12 + 2*dr	2*dr
3	-	-	12 + dr	dr
2	12	12	12	0
1	dp + 6	2*dp + dr	12 - dr	(-1)*dr
0	2*dp	2*dp	12 - 2*dr	(-2)*dr
-1	3*dp - 6	2*dp - dr	12 - 3*dr	(-3)*dr
-2	4*dp - 12	2*dp - 2*dr	12 - 4*dr	(-4)*dr

Red 7, Eight decks

u = 2, n = 8:
rc = (2 - tc)*dp + 8*tc
rc = 2*dp + tc*dr
rc = 16 + (tc - 2)*dr
src = rc - 16
src = (tc - 2)*dr

Red 7, Eight decks

	rc	rc	rc	src
5	-	-	16 + 3*dr	3*dr
4	-	-	16 + 2*dr	2*dr
3	-	-	16 + dr	dr
2	16	16	16	0
1	dp + 8	2*dp + dr	16 - dr	(-1)*dr
0	2*dp	2*dp	16 - 2*dr	(-2)*dr
-1	3*dp - 8	2*dp - dr	16 - 3*dr	(-3)*dr
-2	4*dp - 16	2*dp - 2*dr	16 - 4*dr	(-4)*dr

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Linear Interpolation of Reciprocals

Linear Interpolation by Reciprocals

Y = A1*X + A0

X = (1/k) = (k)^(-1), where k = # decks, so Y = A1*(k^(-1)) + A0 = A1*(1/k) + A0

Interpolation by Reciprocals

Blackjack Attack, 3rd Edition gives values for m1, m2, m6 and m8.

Columns m1, m2, m6 and m8 in BJA3 are really FDPA (Full Deck Player Advantage)
for 1, 2, 6 and 8 decks respectively.

FDHA (Full Deck House Advantage) = (-1) * FDPA (Full Deck Player Advantage)

Interpolate FDHA for "k"decks from m1 (k=1) and m8 (k=8)

Betting, S17, DAS, no LS

k = # decks

*Y = m*X + b*

	X	Y	m	b
k=# decks	1/k	FDHA(k)	slope	Y - m*X
1	1.0000	-0.1735%	n/a	0.5180%
8	0.1250	0.4316%	n/a	0.5180%
	n = (Y8 - Y1) / (X8 - X1) =		-0.6915%	

m = SLOPE(Y-array,X-array) = (Y8 - Y1) / (X8 - X1)

m = -0.6915%

b = INTERCEPT(Y-array,X-array) = Y - m*X

b = 0.5180%

*Y = m*X + b, where Y = FDHA(k), X = (1/k), k = number of decks*

*FDHA(k) = FDHA(1) * { (1/7) * (8/k - 1) }*
*+ FDHA(8) * { (8/7) * (1 - (1/k)) }*

Betting, S17, DAS, no LS

Given:

k	FDHA(k)
1	-0.1735%
8	0.4316%

Calculated:

k	FDHA(k)
2	0.1723%
6	0.4028%

Two linear equations, two unknowns

A1*(1/1) + A0 = -0.1735%

A1*(1/8) + A0 = 0.4316%

Solve for A1 and A0:

A1 = -0.6915%

A0 = 0.5180%

So Y(X) = (-0.6915%)*(X) + 0.5180%, X = (1/k), k = # decks

So Y(k) = (-0.6915%)*(1/k) + 0.5180%

FDHA = Full Deck House Advantage

Linear Interpolation by Reciprocals

k	X = (1/k)	FDHA(k) *Y = m*X + b*	FDHA(k) from BJA3	Difference
1	1.0000	-0.1735%	-0.1735%	0.0000%
2	0.5000	0.1723%	0.1820%	-0.0097%
3	0.3333	0.2875%	n/a	n/a
4	0.2500	0.3452%	n/a	n/a
5	0.2000	0.3797%	n/a	n/a
6	0.1667	0.4028%	0.4041%	-0.0013%
7	0.1429	0.4193%	n/a	n/a
8	0.1250	0.4316%	0.4316%	0.0000%
1000	0.0010	0.5174%	n/a	n/a
infinite	0.0000	0.5180%	n/a	n/a

m = (Y8 - Y1) / (X8 - X1)
= (FDHA(8) - FDHA(1)) / [(1/8) - (1/1)]
= (8/7) * [FDHA(1) - FDHA(8)]

b = Y - m*X
= [Y8 - m*X8] = FDHA(8) - m*(1/8)
= [Y1 - m*X1] = FDHA(1) - m*(1/1)
= FDHA(1) - m

Y = m*X + b

FDHA(k) = m*(1/k) + b

where m = (8/7) * [FDHA(1) - FDHA(8)]
b = FDHA(1) - m

FDHA(k) = FDHA(1) * { (1/7) * (8/k - 1) }
+ FDHA(8) * { (8/7) * (1 - (1/k)) }

Cramer's Rule

Sample Calculation:
Three Linear Equations in Three Unknowns

x	-	2y	+	4z	=	6
x	+	y	+	13z	=	6
-2x	+	6y	-	z	=	-10

1	**-2**	**4**	**6**	**x**	**=**	**-14.000**
1	**1**	**13**	**6**	**y**	**=**	**-6.000**
-2	**6**	**-1**	**-10**	**z**	**=**	**2.000**

		1	**-2**	**4**	1	-2	
D =		**1**	**1**	**13**	1	1	
		-2	**6**	**-1**	-2	6	
=	+		-1	+	52	+	24
	-		-8	-	78	-	2
D	**=**		**3**				

		6	**-2**	**4**	6	-2	
Dx =		**6**	**1**	**13**	6	1	
		-10	**6**	**-1**	-10	6	
=	+		-6	+	260	+	144
	-		-40	-	468	-	12
Dx	**=**		**-42**				

		1	**6**	**4**	1	6	
Dy =		**1**	**6**	**13**	1	6	
		-2	**-10**	**-1**	-2	-10	
=	+		-6	+	-156	+	-40
	-		-48	-	-130	-	-6
Dy	**=**		**-18**				

		1	**-2**	**6**	1	-2	
Dz =		**1**	**1**	**6**	1	1	
		-2	**6**	**-10**	-2	6	
=	+		-10	+	24	+	36
	-		-12	-	36	-	20
Dz	**=**		**6**				

x	=	Dx / D	=	-42	/	3
x	=	-14.000				
y	=	Dy / D	=	-18	/	3
y	=	-6.000				
z	=	Dz / D	=	6	/	3
z	=	2.000				

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Quadratic Interpolation of Reciprocals

Quadratic Interpolation by Reciprocals

Y = A2*X^2 + A1*X + A0

Note: Since X = (1/k) = (k)^(-1), where k = # decks, then Y = A2*(k^(-2)) + A1*(k^(-1)) + A0 = A2*(1/k^2) + A1*(1/k) + A0

Y =	-0.05189%	* X^2	+	-0.63317%	* X	+	0.51156%

FDHA = Full Deck House Advantage

Quadratic Interpolation by Reciprocals

k	X = (1/k)	FDHA(k) from BJA3	FDHA(k) Y quad	Difference
1	1.0000	-0.1735%	-0.1735%	0.0000%
2	0.5000	0.1820%	0.1820%	0.0000%
3	0.3333	n/a	0.2947%	n/a
4	0.2500	n/a	0.3500%	n/a
5	0.2000	n/a	0.3828%	n/a
6	0.1667	0.4041%	0.4046%	-0.0005%
7	0.1429	n/a	0.4200%	n/a
8	0.1250	0.4316%	0.4316%	0.0000%
1000	0.0010	n/a	0.5109%	n/a
infinite	0.0000	n/a	0.5116%	n/a

Betting, S17, DAS, no LS

k	X = (1/k)	X^2	Y
1	1.0000	1.0000	-0.1735%
2	0.5000	0.2500	0.1820%
8	0.1250	0.0156	0.4316%

A2	*	X^2	+	A1	*	X	+	A0	=	Y
A2	*	1.0000	+	A1	*	1.0000	+	A0	=	-0.1735%
A2	*	0.2500	+	A1	*	0.5000	+	A0	=	0.1820%
A2	*	0.0156	+	A1	*	0.1250	+	A0	=	0.4316%

Three Linear Equations, Three Unknowns

Cramer's Rule

1.0000	**1.0000**	**1.0000**	**-0.1735%**	**A2**	**=**	**-0.05189%**
0.2500	**0.5000**	**1.0000**	**0.1820%**	**A1**	**=**	**-0.63317%**
0.0156	**0.1250**	**1.0000**	**0.4316%**	**A0**	**=**	**0.51156%**

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Quadratic Interpolation of Reciprocals

A2	=	D:A2 / D	=	-0.00008513	/	0.1640625
A2	=	-0.0005189				
A1	=	D:A1 / D	=	-0.00103880	/	0.1640625
A1	=	-0.0063317				
A0	=	D:A0 / D	=	0.00083927	/	0.1640625
A0	=	0.005116				

	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000	
D =	0.25000000	0.50000000	1.00000000	0.25000000	0.50000000	
	0.01562500	0.12500000	1.00000000	0.01562500	0.12500000	
=	+	0.50000000	+	0.01562500	+	0.03125000
	-	0.00781250	-	0.12500000	-	0.25000000
D	**=**	**0.16406250**				
	-0.00173500	1.00000000	1.00000000	-0.00173500	1.00000000	
D:A2 =	*0.00182000*	0.50000000	1.00000000	0.00182000	0.50000000	
	0.00431600	0.12500000	1.00000000	0.00431600	0.12500000	
=	+	-0.00086750	+	0.00431600	+	0.00022750
	-	0.00215800	-	-0.00021688	-	0.00182000
D:A2	**=**	**-0.00008513**				
	1.00000000	*-0.00173500*	1.00000000	1.00000000	-0.00173500	
D:A1 =	0.25000000	*0.00182000*	1.00000000	0.25000000	0.00182000	
	0.01562500	*0.00431600*	1.00000000	0.01562500	0.00431600	
=	+	0.00182000	+	-0.00002711	+	0.00107900
	-	0.00002844	-	0.00431600	-	-0.00043375
D:A1 =	**=**	**-0.00103880**				
	1.00000000	1.00000000	*-0.00173500*	1.00000000	1.00000000	
D:A0 =	0.25000000	0.50000000	*0.00182000*	0.25000000	0.50000000	
	0.01562500	0.12500000	*0.00431600*	0.01562500	0.12500000	
=	+	0.00215800	+	0.00002844	+	-0.00005422
	-	-0.00001355	-	0.00022750	-	0.00107900
D:A0	**=**	**0.00083927**				

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

Cubic Interpolation by Reciprocals
Y = A3*X^3 + A2*X^2 + A1*X + A0
Note: Since X = (1/k) = (k)^(-1), where k = # decks, then Y = A3*(k^(-3)) + A2*(k^(-2)) + A1*(k^(-1)) + A0 = A3*(1/k^3) + A2*(1/k^2) + A1*(1/k) + A0

Y =	-0.04210%	* X^3	+	0.01653%	* X^2	+	-0.66212%	* X	+	0.51419%

FDHA = Full Deck House Advantage
Cubic Interpolation by Reciprocals

k	X = (1/k)	FDHA(k) from BJA3	FDHA(k) Y cubic	Difference
1	1.0000	-0.1735%	-0.1735%	0.0000%
2	0.5000	0.1820%	0.1820%	0.0000%
3	0.3333	n/a	0.2938%	n/a
4	0.2500	n/a	0.3490%	n/a
5	0.2000	n/a	0.3821%	n/a
6	0.1667	0.4041%	0.4041%	0.0000%
7	0.1429	n/a	0.4198%	n/a
8	0.1250	0.4316%	0.4316%	0.0000%
1000	0.0010	n/a	0.5135%	n/a
infinite	0.0000	n/a	0.5142%	n/a

Betting, S17, DAS, no LS

Comparison of FDHA(k) calculations

k	FDHA(k) Y cubic	FDHA(k) Y quadratic	FDHA(k) Y linear
1	-0.1735%	-0.1735%	-0.1735%
2	0.1820%	0.1820%	0.1723%
3	0.2938%	0.2947%	0.2875%
4	0.3490%	0.3500%	0.3452%
5	0.3821%	0.3828%	0.3797%
6	0.4041%	0.4046%	0.4028%
7	0.4198%	0.4200%	0.4193%
8	0.4316%	0.4316%	0.4316%
1000	0.5135%	0.5109%	0.5174%
infinite	0.5142%	0.5116%	0.5180%

Betting, S17, DAS, no LS

k	X = (1/k)	X^2	X^3	FDHA(k) from BJA3 Y
1	1.0000	1.0000	1.0000	-0.1735%
2	0.5000	0.2500	0.1250	0.1820%
6	0.1667	0.0278	0.0046	0.4041%
8	0.1250	0.0156	0.0020	0.4316%

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

A3	*	X^3	+	A2	*	X^2	+	A1	*	X	+	A0	=	Y
A3	*	1.0000	+	A2	*	1.0000	+	A1	*	1.0000	+	A0	=	-0.1735%
A3	*	0.1250	+	A2	*	0.2500	+	A1	*	0.5000	+	A0	=	0.1820%
A3	*	0.0046	+	A2	*	0.0278	+	A1	*	0.1667	+	A0	=	0.4041%
A3	*	0.0020	+	A2	*	0.0156	+	A1	*	0.1250	+	A0	=	0.4316%

Four Linear Equations, Four Unknowns

Cramer's Rule

1.0000	**1.0000**	**1.0000**	**1.0000**	**-0.1735%**	**A3**	**=**	**-0.04210%**
0.1250	**0.2500**	**0.5000**	**1.0000**	**0.1820%**	**A2**	**=**	**0.01653%**
0.0046	**0.0278**	**0.1667**	**1.0000**	**0.4041%**	**A1**	**=**	**-0.66212%**
0.0020	**0.0156**	**0.1250**	**1.0000**	**0.4316%**	**A0**	**=**	**0.51419%**

A3	=	D:A3 / D	=	-0.000000799	/	0.001898872
A3	=	-0.0004210				
A2	=	D:A2 / D	=	0.000000314	/	0.001898872
A2	=	0.0001653				
A1	=	D:A1 / D	=	-0.000012573	/	0.001898872
A1	=	-0.0066212				
A0	=	D:A0 / D	=	0.000009764	/	0.001898872
A0	=	0.0051419				

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

		1.0000000	1.0000000	1.0000000	1.0000000		
D	**=**	0.1250000	0.2500000	0.5000000	1.0000000	=	0.001898872
		0.0046296	0.0277778	0.1666667	1.0000000		
		0.0019531	0.0156250	0.1250000	1.0000000		

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.04166667	+	0.00781250	+	0.00347222	
		-	0.00260417	-	0.03125000	-	0.01388889	
1.0000000	*		0.00520833				=	0.005208333
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.16666667	+	0.01562500	+	0.00347222	
		-	0.00260417	-	0.12500000	-	0.02777778	
-0.1250000	*		0.03038194				=	-0.003797743
		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.50000000	+	0.01562500	+	0.03125000	
		-	0.00781250	-	0.12500000	-	0.25000000	
0.0046296	*		0.16406250				=	0.000759549
		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000		
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000		
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667		
		+	0.50000000	+	0.02777778	+	0.04166667	
		-	0.01388889	-	0.16666667	-	0.25000000	
-0.0019531	*		0.13888889				=	-0.000271267
						D	**=**	0.001898872

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

	-0.0017350	1.0000000	1.0000000	1.0000000		
D:A3	*0.0018200*	0.2500000	0.5000000	1.0000000	=	-0.000000799
	0.0040410	0.0277778	0.1666667	1.0000000		
	0.0043160	0.0156250	0.1250000	1.0000000		

		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.04166667	+	0.00781250	+	0.00347222	
		-	0.00260417	-	0.03125000	-	0.01388889	
-0.0017350	*		0.00520833				=	-0.000009036

		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.02777778	0.16666667	1.00000000	0.02777778	0.16666667		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.16666667	+	0.01562500	+	0.00347222	
		-	0.00260417	-	0.12500000	-	0.02777778	
-0.0018200	*		0.03038194				=	-0.000055295

		1.00000000	1.00000000	1.00000000	1.00000000	1.00000000		
		0.25000000	0.50000000	1.00000000	0.25000000	0.50000000		
		0.01562500	0.12500000	1.00000000	0.01562500	0.12500000		
		+	0.50000000	+	0.01562500	+	0.03125000	
		-	0.00781250	-	0.12500000	-	0.25000000	
0.0040410	*		0.16406250				=	0.000662977

		1.0000000	1.0000000	1.0000000	1.00000000	1.00000000		
		0.2500000	0.5000000	1.0000000	0.25000000	0.50000000		
		0.0277778	0.1666667	1.0000000	0.02777778	0.16666667		
		+	0.50000000	+	0.02777778	+	0.04166667	
		-	0.01388889	-	0.16666667	-	0.25000000	
-0.0043160	*		0.13888889				=	-0.000599444
							D:A3	**=** -0.000000799

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

	1.0000000	*-0.0017350*	1.0000000	1.0000000				
D:A2	0.1250000	*0.0018200*	0.5000000	1.0000000	=	0.000000314		
	0.0046296	*0.0040410*	0.1666667	1.0000000				
	0.0019531	*0.0043160*	0.1250000	1.0000000				

		0.00182000	0.50000000	1.00000000	0.00182000	0.50000000		
		0.00404100	0.16666667	1.00000000	0.00404100	0.16666667		
		0.00431600	0.12500000	1.00000000	0.00431600	0.12500000		
		+	0.00030333	+	0.00215800	+	0.00050513	
		-	0.00071933	-	0.00022750	-	0.00202050	
1.0000000	*		-0.00000088				=	-0.000000875
		-0.00173500	1.00000000	1.00000000	-0.00173500	1.00000000		
		0.00404100	0.16666667	1.00000000	0.00404100	0.16666667		
		0.00431600	0.12500000	1.00000000	0.00431600	0.12500000		
		+	-0.00028917	+	0.00431600	+	0.00050513	
		-	0.00071933	-	-0.00021688	-	0.00404100	
-0.1250000	*		-0.00001150				=	0.000001438
		-0.00173500	1.00000000	1.00000000	-0.00173500	1.00000000		
		0.00182000	0.50000000	1.00000000	0.00182000	0.50000000		
		0.00431600	0.12500000	1.00000000	0.00431600	0.12500000		
		+	-0.00086750	+	0.00431600	+	0.00022750	
		-	0.00215800	-	-0.00021688	-	0.00182000	
0.0046296	*		-0.00008513				=	-0.000000394
		-0.0017350	1.0000000	1.0000000	-0.00173500	1.00000000		
		0.0018200	0.5000000	1.0000000	0.00182000	0.50000000		
		0.0040410	0.1666667	1.0000000	0.00404100	0.16666667		
		+	-0.00086750	+	0.00404100	+	0.00030333	
		-	0.00202050	-	-0.00028917	-	0.00182000	
-0.0019531	*		-0.00007450				=	0.000000146
							D:A2 =	0.000000314

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

	1.0000000	1.0000000	*-0.0017350*	1.0000000				
D:A1	0.1250000	0.2500000	*0.0018200*	1.0000000	=	-0.000012573		
	0.0046296	0.0277778	*0.0040410*	1.0000000				
	0.0019531	0.0156250	*0.0043160*	1.0000000				
		0.25000000	0.00182000	1.00000000	0.25000000	0.00182000		
		0.02777778	0.00404100	1.00000000	0.02777778	0.00404100		
		0.01562500	0.00431600	1.00000000	0.01562500	0.00431600		
		+	0.00101025	+	0.00002844	+	0.00011989	
		-	0.00006314	-	0.00107900	-	0.00005056	
1.0000000	*		-0.00003412				=	-0.000034120
		1.00000000	-0.00173500	1.00000000	1.00000000	-0.00173500		
		0.02777778	0.00404100	1.00000000	0.02777778	0.00404100		
		0.01562500	0.00431600	1.00000000	0.01562500	0.00431600		
		+	0.00404100	+	-0.00002711	+	0.00011989	
		-	0.00006314	-	0.00431600	-	-0.00004819	
-0.1250000	*		-0.00019717				=	0.000024646
		1.00000000	-0.00173500	1.00000000	1.00000000	-0.00173500		
		0.25000000	0.00182000	1.00000000	0.25000000	0.00182000		
		0.01562500	0.00431600	1.00000000	0.01562500	0.00431600		
		+	0.00182000	+	-0.00002711	+	0.00107900	
		-	0.00002844	-	0.00431600	-	-0.00043375	
0.0046296	*		-0.00103880				=	-0.000004809
		1.0000000	-0.0017350	1.0000000	1.00000000	-0.00173500		
		0.2500000	0.0018200	1.0000000	0.25000000	0.00182000		
		0.0277778	0.0040410	1.0000000	0.02777778	0.00404100		
		+	0.00182000	+	-0.00004819	+	0.00101025	
		-	0.00005056	-	0.00404100	-	-0.00043375	
-0.0019531	*		-0.00087575				=	0.000001710
							D:A1 **=**	-0.000012573

Estimation of FDHA (Full Deck House Advantage) for "k" decks
by Method of
Cubic Interpolation of Reciprocals

	1.0000000	1.0000000	1.0000000	*-0.0017350*		
D:A0	0.1250000	0.2500000	0.5000000	*0.0018200*	=	0.000009764
	0.0046296	0.0277778	0.1666667	*0.0040410*		
	0.0019531	0.0156250	0.1250000	*0.0043160*		

		0.25000000	0.50000000	0.00182000	0.25000000	0.50000000			
		0.02777778	0.16666667	0.00404100	0.02777778	0.16666667			
		0.01562500	0.12500000	0.00431600	0.01562500	0.12500000			
		+	0.00017983	+	0.00003157	+	0.00000632		
		-	0.00000474	-	0.00012628	-	0.00005994		
1.0000000	*		0.00002676					=	0.000026758
		1.00000000	1.00000000	-0.00173500	1.00000000	1.00000000			
		0.02777778	0.16666667	0.00404100	0.02777778	0.16666667			
		0.01562500	0.12500000	0.00431600	0.01562500	0.12500000			
		+	0.00071933	+	0.00006314	+	-0.00000602		
		-	-0.00000452	-	0.00050513	-	0.00011989		
-0.1250000	*		0.00015595					=	-0.000019494
		1.00000000	1.00000000	-0.00173500	1.00000000	1.00000000			
		0.25000000	0.50000000	0.00182000	0.25000000	0.50000000			
		0.01562500	0.12500000	0.00431600	0.01562500	0.12500000			
		+	0.00215800	+	0.00002844	+	-0.00005422		
		-	-0.00001355	-	0.00022750	-	0.00107900		
0.0046296	*		0.00083927					=	0.000003886
		1.0000000	1.0000000	-0.0017350	1.00000000	1.00000000			
		0.2500000	0.5000000	0.0018200	0.25000000	0.50000000			
		0.0277778	0.1666667	0.0040410	0.02777778	0.16666667			
		+	0.00202050	+	0.00005056	+	-0.00007229		
		-	-0.00002410	-	0.00030333	-	0.00101025		
-0.0019531	*		0.00070928					=	-0.000001385
							D:A0	**=**	0.000009764