The Shifted Red 7 Count

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[I would like to thank ET Fan for reviewing Conrad Membrino's initial work and providing invaluable early guidance and assistance to him. ET Fan has not reviewed the final articles, however, so there may be errors. If any readers find errors in these articles, please post your comments for Conrad on our Blackjack Main discussion board. Thank you -- A.S.]

Shifted Red 7 Running Count

This paper will cover the "shifted" variation where you start your count at -2 times the number of decks, plus information on how to true the Red 7 in 2-deck games. Both the table of critical running counts method and the shifted Red 7 method produce the same result so the reader can choose whichever method he finds easier. Refer to Exhibits in the Appendix to this paper for definition of terms used in this paper and for clarification of calculations and methods presented in the body of this paper.

In the table of critical running counts playing strategy changes were made when the Red 7 running count was greater than or equal to the critical running count which was looked up in the table of critical running counts by true count (index of the playing strategy under consideration) and decks played.

Here is how the table of critical running counts was constructed. If crc(tc, dp) = critical running count corresponding to the true count "tc" and number of decks played "dp" and if n = number of decks and dr = decks remaining = (n – dp) then crc(tc, dp) = 2*n + (tc – 2)*dr. The rule used for strategy variation with the table of critical running counts is to make the playing strategy change if Red 7 >= crc (Idx, dp). If rc = Red 7 running count and src = shifted Red 7 running count = rc – 2*n, then this critical running count table can be summarized as follows.

(1) **Playing Strategy Departure if rc >= crc(Idx, dp)** (crc from table of critical running counts)
(2) crc(Idx, dp) = 2*n + (Idx – 2)*dr
(3) Playing Strategy Departure if rc >= 2*n + (Idx – 2)*dr
(4) Playing Strategy Departure if rc – 2*n >= (Idx – 2)*dr
(5) **Playing Strategy Departure if src >= (Idx – 2)*dr**[1]

So making a playing strategy departure if the un-shifted Red 7 running count, rc, is greater than or equal to the entry in the table of critical running counts (item (1) above) is mathematically equivalent to making the playing strategy departure if src >= (Idx – 2)*dr (item (5) above). Idx = Red 7 index which, when rounded to the nearest integer, can be taken as essentially equal to[2] the Hi-Low index. The following sections of this paper will describe using the shifted Red 7 running count for betting and playing strategy changes with the six and eight deck games and with the two deck game.

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[1] tc = 2 + (rc – 2*n)/dr = 2 + (src/dr). Strategy change occurs when true count >= Index. So playing strategy changes if 2 + (src/dr) >= Idx which can be written as playing strategy change if src >= (Idx – 2)*dr.

[2] *Truing the Red 7 count: Exhibit D2, Comparison of Red 7 and Hi-Low indices* shows that the Red 7 and Hi-Low indices, when rounded to the nearest integer, are essentially equal.

Shifted Red 7 Running Count used with the Six and Eight Deck games

Instead of using the critical running count tables presented earlier for the six and eight deck game, the shifted Red 7 running count may be used, similar to its use with the two deck game.

The shifted Red 7 running count is started at -2*n at the beginning of the shoe, where n = number of decks, i.e. src = rc – 2*n. So for the six deck game the count is started at -12 instead of zero (src = rc - 12) and for the eight deck game, the count is started at -16 instead of zero (src = rc – 16).

If the shifted Red 7 is to be used with the six and eight deck game, my suggestion is not to start the Red 7 count at -2*n, but to start back counting with the Red 7 count starting at zero as usual. Then table departure for the six deck game occurs at -3, 0, 3 and 6 and for the eight deck game at -6, -3, 0, 3, 6 and 9 as described in *How to Increase Your Earnings with the Red 7 – Part I*. If the Red 7 count later exceeds 2*n, which indicates table entry, then the Red 7 running count can be converted to the shifted Red 7 running count by subtracting 2*n from the running count at the end of the round when the Red 7 running count first exceeds 2*n which will essentially convert the Red 7 running count to the shifted Red 7 running count, src. Then this src can be used for the remainder of the shoe with betting and playing strategy decisions as shown below.

For the six and eight deck game, units bet is one plus the shifted running count divided by decks remaining, i.e. units bet = 1 + (src/dr). Note that since the true count is 2 + (src/dr) then the suggested units bet is basically the true count minus one. 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.

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:

Six or Eight Deck back counted game:	
6 decks:	src = rc – 12
8 decks:	src = rc – 16
units bet = 1 + (src/dr), maximum bet = 4 units	
Playing Strategy Change if	src >= (Idx – 2)*dr

So for the six and eight deck games, the shifted running count is an option to use instead using the Red 7 directly with the tables of critical running counts shown earlier.[3] Also the Hi-Low indices, as mentioned earlier, give a good approximation to the Red 7 indices, so the Hi-Low indices may be used for “Idx” in the above formula for playing strategy variations.

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[3] Both the table of critical running counts and the above formula are equivalent as can be seen by this example. Suppose n = 6 decks, src = 8, dr = 4 with hard 15 v T. Units bet = 1 + 8/4 = 3. For hard 15 v T, Idx = 4 so (Idx-2)*dr = (4-2)*4 = 8. Since src = 8 then src >= (Idx – 2)*dr so stand. For this same situation, using the six deck table of critical running counts gives the following results. Since src = rc – 12 then src = 8, means that the un-shifted Red 7 running count, rc, is 8 + 12 = 20. If dr = 4 then dp = 2 and if rc = 20 then units bet = 3. Also the critical running count for a true count index of 4 and two decks played is 20. Since Red 7 >= 20, then stand on h 15 v T.

Shifted Red 7 Running Count used with the Two Deck game

With the two deck game there is no back counting and so every hand needs to be played. The table of running counts shown earlier was constructed for back counting the shoe game and so had entries for true counts of 2, 3, 4 and 5 only. A similar table would not be appropriate for the two deck game where every hand is played and true counts have a large range of values that quickly change. So the shifted Red 7 running count must be used with the two deck game.

The shifted Red 7 running count, src, is defined as the Red 7 count minus twice the number of decks. With the two deck game using the shifted Red 7 running count, the count is started at -4 at the beginning of the shoe. If decks played is 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.

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.

If dp = decks played, dr = decks remaining, rc = Red 7 running count, src = shifted running count and Idx = index for playing strategy change (the Hi-Low indices may be used for the Red 7 strategy change with very little loss in accuracy), then the chart below summarizes the two deck play all game:

Two Deck play all game:	
src = rc - 4	
0 < dp < 1:	units bet = src + 2, max bet = 6
1 < dp < 1.5:	units bet = src + 3, max bet = 6
Playing Strategy Change if	src >= (Idx - 2) * dr

For hard 15 against a Ten, the Hi-Low index is +4. So if the shifted running is greater than or equal to twice the decks remaining, then stand, otherwise hit. This can be seen by using Idx = 4 in the formula above: src >= (Idx – 2)*dr = (4-2)*dr = 2*dr. As another example, the index for hard 16 against a Ten is zero. So stand if src >= (Idx – 2)*dr = (0-2)*dr = -2*dr, i.e. stand on hard 16 against a Ten if the shifted running count is greater than or equal to minus two times the decks remaining. Another example is splitting T,T against a 6. The index for splitting T,T against a 6 is +5 so the player would split T,T against a 6 if src >= (Idx – 2)*dr = (5-2)*dr = 3*dr. As a final example, the index for insurance for two decks is +2.4. So insure if src >= (Idx – 2)*dr = (2.4-2)*dr = 0.4*dr, i.e. if the shifted Red 7 running count is greater than or equal to 0.4 times decks remaining, then insure. Since decks remaining, dr, range from 2 to 0.5 then 0.4*dr range from 0.8 to 0.2 and since the shifted running count, src, can only be zero or one then this is equivalent to insuring if src >= 1. Values of "Idx" used in the formula above may be taken as the corresponding Hi-Low index for the particular strategic situation under consideration, as mentioned above. More precise Red 7 indices for the two deck game can be found in the *Truing the Red 7 count* paper. For the two deck game, the Red 7 should be replaced with the Seven Unbalanced count.

Shifted Seven Unbalanced Count for Two Deck Game

If additional gain is desired, the level one Red 7 count can be replaced with the level two Seven Unbalanced count. The Seven Unbalanced count, 7u, is similar to the Red 7 but instead of counting the red 7's as plus one and the black 7's as zero, all sevens are counted as plus one half. Both counts have a pivot at a true count of 2. The Seven Unbalanced count increases the betting, insurance and playing efficiency of the Red 7 but at a cost of introducing a slightly more complicated level two count.

The Seven Unbalanced count may be used interchangeably with the Red 7 count without any playing strategy, insurance or betting changes just as if it were the Red 7 count. With the Seven Unbalanced count, all of the playing strategy indices, insurance and betting charts of the Red 7 may be used directly by using the Seven Unbalanced count as if it were the Red 7 count. No changes need to be made except in the count itself where all seven are now counted as one half instead of just the red 7's counted as plus one and black 7's as zero. See Exhibits 2A, 2B and 2C in the Appendix for a comparison of the Red 7 and Seven Unbalanced counts.

Below is a comparison of S17 and H17 betting efficiencies for the Red 7 and Seven Unbalanced counts.

Betting, S17, DAS, no LS				
Count	Red 7		Count	7u
k (# decks) =	2		k (# decks) =	2
Cor Coef	96.83%		Cor Coef	98.00%
AACpTCp	0.495%		AACpTCp	0.507%
FDHA,"k" dks	0.182%		FDHA,"k" dks	0.182%
Index, Idx	**0.368**		Index, Idx	**0.359**
Betting, H17, DAS, no LS				
Count	Red 7		Count	7u
k (# decks) =	2		k (# decks) =	2
Cor Coef	96.98%		Cor Coef	98.15%
AACpTCp	0.514%		AACpTCp	0.527%
FDHA,"k" dks	0.384%		FDHA,"k" dks	0.384%
Index, Idx	**0.746**		Index, Idx	**0.729**

See Exhibit 3A in the Appendix for definitions of the above terms and see Exhibit 3B for the calculation of player's advantage at true count "t", pa(t), using the Index, Idx, and Average Advantage Change per True Count point, AACpTCp. The formula is pa(t) = AACpTCp * (t – Idx) and note that when t = Idx, then pa(Idx) = 0, i.e. true count equal to the index is the break-even point where the player has neither an advantage nor a disadvantage.

For the two deck game, the Seven Unbalanced count, 7u, should replace the Red 7 count as the additional accuracy for playing strategy is worth the additional effort of keeping this simplest of level two counts. The shifted Seven Unbalanced count, s7u, starts, for the two deck game, at -4, similar to the shifted Red 7 count, src, starting at -4 for the two deck game. Unlike the shoe game, where the 7u count, if used, would need to be kept for say 4.5 out of 6 decks, with the two deck, 1.5 deck dealt game, the 7u count needs to be kept for only 1.5 decks. The extra effort in keeping this 7u level two count is recommended for the two deck game but is not recommended for the shoe games.

Shown below are insurance indices for both the Red 7 and the Seven Unbalanced, 7u, count. Notice how close the Red 7 and Seven Unbalanced indices are. This is typical of Red 7 and Seven Unbalanced playing strategy indices and is why the counts may be used interchangeably.

Insurance				
Count	Red 7		Count	7u
k (# decks) =	2		k (# decks) =	2
Cor Coef	78.53%		Cor Coef	79.50%
AACpTCp	2.339%		AACpTCp	2.397%
FDHA,"k" dks	7.692%		FDHA,"k" dks	7.692%
MDHA,"k" dks	6.796%		MDHA,"k" dks	6.796%
MT, "k" dks	(0.505)		MT, "k" dks	(0.505)
YI, "k" decks	(0.0194)		YI, "k" decks	(0.0194)
Index, Idx	**2.381**		Index, Idx	**2.311**

Strategy change occurs if s7u >= (Idx - 2)*dr. Since s7u = 7u – 2*n where n = # decks, then strategy change occurs when 7u >= 2*n + (Idx – 2)*dr where Idx is the playing strategy index for the Seven Unbalanced count for the particular playing strategy variation under consideration. The Seven Unbalanced index is approximately the Red 7 index which is approximately the Hi-Low index.

The chart below summarizes the two deck game using the Seven Unbalanced count which is the same as the chart for the Red 7 count with s7u, the shifted Seven Unbalanced Count, replacing the src, the shifted Red 7 count.

Two Deck play all game:	
s7u = 7u – 4	
0 < dp < 1:	units bet = s7u + 2, max bet = 6
1 < dp < 1.5:	units bet = s7u + 3, max bet = 6
Playing Strategy Change if	s7u >= (Idx - 2) * dr

Applying the generalized playing strategy change formulas, src >= (Idx – 2)*dr and s7u >= (Idx – 2)*dr, to insurance and using the insurance indices shown above, the following results are obtained:

Two Deck Insurance				
src = Shifted Red 7			s7u = Shifted Seven Unbalanced	
Insure if src >= (2.381 - 2)*dr			Insure if s7c >= (2.311 - 2)*dr	
Insure if src >= 0.381*dr			Insure if s7u >= 0.311*dr	
dr	0.381*dr		dr	0.311*dr
2.0	0.76		2.0	0.62
1.5	0.57		1.5	0.47
1.0	0.38		1.0	0.31
0.5	0.19		0.5	0.16

The shifted Red 7 count, src, can be 0 or 1, so insurance is taken if src >= 1, regardless of the number of decks remaining. The shifted Seven Unbalanced count, s7u, can be 0, 0.5 or 1 so with the s7u a more refined insurance decision can be made. So the insurance rule is to always take insurance whenever either src >= 1 or s7u >= 0.5.

Technically, if dp < ½, then the Seven Unbalanced two deck insurance rule should be to insure if s7u >= 1. However, the error in using the simplified Seven Unbalanced insurance rule above, which is to always insure whenever s7u >= 0.5, is negligible. Consider the worst case where, during the first round of a two deck game, the dealer's up card is an Ace and six more cards are seen giving s7u = 0.5. Then dp = 7/52 = 0.135 so dr = (2 – 0.135) = 1.865 and tc = 2 + (s7u/dr) = 2 + (0.5/1.865) = 2.268. The Seven unbalanced count two deck index is 2.311 and AACpTCp is 2.397%. So using pa(t) = AACpTCp * (t – Idx) gives pa(2.268) = 2.397% * (2.268 – 2.311) = -0.1%. So if two deck insurance is always taken whenever s7u >= 0.5, the worse situation would be that the player would be taking insurance with an average 0.1% disadvantage. Considering that insurance also reduces bankroll fluctuations, the simplified Seven Unbalanced insurance rule, insure if s7u >= 0.5, is recommended.

Commentary: Red 7 Superiority over the Hi-Low

Philadelphia Park Casino in Bensalem, Pennsylvania opened for table games on Sunday, July 18, 2010. Most of the tables were six decks but there were some eight deck tables. The games are dealer stands on Soft 17 and later surrender is allowed. That is the good news - now the bad news.

There was a cover over the shoe so that the players could not see how many cards were left to be dealt or where the cut card is. Also there was a slot for the discards so that the discard rack was not on the table but rather beneath the table so there is no way of telling how many decks have been dealt. When the cut card did come out, the discard tray was pulled up from the table and the cards removed. There was an automatic shuffler so a new set of decks was immediately available so no time was wasted on shuffling. Of course, by not being able to see the cards remaining in the shoe or the cards in the discard rack, the error in estimating the decks played or decks remaining are very great. For a balanced count, such as the Hi-Low, this is very devastating as it can lead to large inaccuracies in estimating the true count. But for the Red 7 with a pivot of a true count of 2, the problem is not as great. Of course, you do not know when a shoe is about to be end or if it has just begun unless you actually witnessed the end of the shoe (or ask the dealer or a player at the table if the shoe just started). This definitely makes back counting more difficult. But as showed in *Truing the Red 7* paper, the Red 7 is much less sensitive to errors in estimating the decks played than the Hi-Low for true counts of 2, 3, 4 and 5. For true counts of 2, the Red 7 is independent of the decks played so there is no error at all. For the six deck game, whenever the Red 7 is 12, the true count is 2 everywhere in the shoe and you have a 0.5% basic strategy advantage. So using the Red 7, if you back count and enter the six deck game only when the Red 7 >= 12, you will not risk playing at a disadvantage because you cannot estimate the decks played. Opportunities arise very slowly in the shoe game – with the Red 7, you catch every profitable betting opportunity. The same cannot be said for the Hi-Low, where, since you cannot estimate the decks played very well, you may either be conservative and wait too long to enter and thereby miss profitable betting opportunities or you may be too quick to enter the game and begin play at a marginal advantage or, even worse, at a disadvantage. The Philadelphia Park Casino obviously put this in to foil card counters and they were thinking of card counters using just the Hi-Low count, not an unbalanced count such as the Red 7.

Below is the six deck Red 7 table of critical running counts and for illustrative purposes, I have also showed the six deck Hi-Low table of critical running counts. Remember, for true counts of 2, 3, 4, and 5 the Red 7 is much more accurate (less sensitive to errors in estimating the decks played) than the Hi-Low is, as shown in Exhibit E *Sensitivity of Red 7 True Count to Errors in Estimating Decks Played* found in the *Truing the Red 7 count* paper. I will also demonstrate this with the Red 7 and Hi-Low table of critical running counts below. Suppose the situation was a hard 15 v T standing decision. The Hi-Low index (which is also approximately the Red 7 index) is +4. If the decks played were estimated at 3 then the decks remaining is also three and so for the Hi-Low count the estimated critical running count is Idx*dr = 4*3 = 12, i.e. if the Hi-Low running count is greater than 12 then stand. But suppose that the decks played were actually two and not three. Then the Hi-Low critical running count would be Idx*dr = 4*4 = 16 as highlighted in yellow in the table below. So with the Hi-Low count, this error in estimating the decks played lead to an error in the Hi-Low critical running count of (16 - 12) = 4 running count points since a true count of four is four true count points above the Hi-Low pivot of a true count of zero. Now consider the Red 7 for this same situation. The critical running count using the estimated decks played as 3 is 18. But if the actual decks played were 2 instead of 3 then the Red 7 critical running count would be 20. So with the Red 7 count, this error in estimating the decks played lead to an error in the Red 7 critical running count of (20 - 18) = 2 running count points since a true count of four is only two true count points above the Red 7 pivot point of a true count of two. So, as you can see, the Red 7 true count calculations are less sensitive to errors in estimating the decks played, for true counts of 2, 3, 4 and 5 (and for a true count of two, the Red 7 it is totally independent of the decks played), than a similar error in the estimate of the decks played for a balanced count, such as the Hi-Low.

Hi-Low

Six Deck Table of Critical Running Counts: crc = tc*dr

Decks Played

tc	1	2	3	4	5
2	10	8	6	4	2
3	15	12	9	6	3
4	20	16	12	8	4
5	25	20	15	10	5

Red 7

Six Deck Table of Critical Running Counts: crc = 12 + (tc - 2)*dr

Decks Played

tc	1	2	3	4	5
2	12	12	12	12	12
3	17	16	15	14	13
4	22	20	18	16	14
5	27	24	21	18	15

An alternative way of looking at this same situation mentioned above is using Hi-Low and Red 7 true count formulas. In the example above, Hi-Low running count was 12 and estimated decks remaining was 3 so estimated Hi-Low true count was 12/3 = 4.0. But actual decks remaining was 4 and not 3 so the actual Hi-Low true count was 12/4 = 3.0. The Red 7 running count was 18 and the estimated decks remaining was 3 so the six deck Red 7 true count, 2 + (rc – 12)/dr, was estimated 2 + (18 – 12)/3 = 4.0. But the decks remaining is actually 4 and not 3 so the actual Red 7 true count was 2 + (18 – 12)/4 = 3.5. So, in this example, the same error in estimating decks remaining lead to an error of 1.0 true count for the Hi-Low but only 0.5 true count for the Red 7.

Using the Red 7 count, the errors in estimating the decks played, due to not being able to see the cut card, the cards in the shoe or the cards in the discard tray, is reduced. As long as you bet only when the Red 7 is greater than or equal to 12 (for the six deck game) you are always playing with at least a 0.5% basic strategy advantage anywhere in the shoe, regardless of decks played. And as an approximation, since you cannot determine the decks played since you cannot see them, you can just use the decks played column 3 in the table of critical running counts. So for the six deck game, 12 is a true count or 2 (everywhere in the shoe) and then use 15 as a true count of 3, 18 as a true count of 4 and 21 as a true count of 5, and the errors will not be that great. If you think you are in the first third of the shoe, you can use decks played column 2 which is 12, 16, 20 and 24 for true counts of 2, 3, 4 and 5 respectively and if you feel you are near the end of the shoe you can use decks played column 4 which is 12, 14, 16 and 18 for true counts of 2, 3, 4 and 5 respectively, but if you are unsure how many decks have been played, then just use decks played column 3 which is 12, 15, 18 and 21 for true counts of 2, 3, 4 and 5 with recommended bets of 1, 2, 3 and 4 units, respectively.

Interpolation can be used for more refined betting. Thus, if the six deck game is assumed to be at the three deck dealt level, then the recommended bets are 1, 2, 3 and 4 units at Red 7 running counts of 12, 15, 18 and 21 respectively, as mentioned above. So interpolating, a Red 7 running count of 13 or 14 suggests a bet of 1.5 units, a Red 7 running count of 16 or 17 suggests a bet of 2.5 units and a Red 7 running count of 19 or 20 suggests a bet of 3.5 units. A Red 7 running count of 9 corresponds to a true count of 1. It is best to sit out hands if the Red 7 is less than 12, but if you must play then bet one hand at a fraction of a unit if 9 <= Red 7 < 12 and do not bet at all for Red 7 < 9.

How to Increase Your Earnings with the Red 7 - Part 1 showed that the day trip bankroll required for 2.5% risk of ruin for a one to four unit bet spread with no change in either the unit bet size or maximum bet size of four units, irrespective of the size of the current bankroll, as 80 units. So if two hands with unit bets of $25 each were to be bet according to this schedule, then the required day trip bankroll is calculated as follows. Two hands of $25 each is equivalent, from a risk point of view, to one hand at (4/3)*$25.[4] So the required day trip bankroll for 2.5% risk of ruin of betting $25 to $100 on each of two hands is risk equivalent to betting ((4/3)*$25) to ((4/3)*$100) on a single hand which requires a day trip 80 unit bankroll which is a bankroll of 80*((4/3)*$25) ≈ $2,700.

[4] The bet for a single hand can be increased 50% and the total 150% bet spread to two hands with the same risk. So a $100 bet on one hand is equivalent, from a risk point of view, to $150 spread over two hands. i.e., two hands at $75 each. So a bet of (4/3)*($25) on a single hand has the equivalent risk of a two hand total bet of 1.50*(4/3)*($25) or a bet of (1/2)*(1.50)*(4/3)*($25) = $25 on each of two hands.

Following is a general rule for playing multiple hands. If you must play at true counts below 2, then play one hand and if possible the bet should be a fraction of a unit. At true counts of 2 or 3 play either one or two hands. If the true count is greater than or equal to four, then play two hands with each hand being ¾th's of the recommended bet for a single hand. An exception to this rule is if you are the only player at the table. If there are no other players at the table, then the high cards are not used up by extra players. So heads up against the dealer, it is best to play one hand so that you obtain as many independent hands as possible. Another exception is if the cut card is about to come out. If you know you are at the last round of the shoe then play two or even three hands, even if you are the only player at the table.

Examination of Various Betting Schedules

The balance of this paper will consist of an examination of various betting schedules and combination of betting schedules with my final recommended betting schedule combination at the end of this paper.

"Tot Adv", total player's advantage (basic strategy + playing strategy), is calculated in Exhibits 4I-a, 4I-b. The last column of the table below takes the ratio of the total advantage of true counts from 2 to 10 to the total advantage at a true count of 2. The number of units bet should be proportional to the total advantage. The suggested units bet of 1, 2, 3 and 4 for true counts 2, 3, 4 and 5 are very close to being proportional to the total advantage. For true counts over 5, a maximum bet of 4 units is typically used to reduce fluctuation and risk of ruin.

Total Player Advantage (ta) by Red 7 true count		
Red 7 "tc" (t)	tot adv (ta)	ta(t)/ta(2)
2	0.66%	1.0
3	1.21%	1.8
4	1.90%	2.9
5	2.71%	4.1
6	3.59%	5.4
7	4.46%	6.7
8	5.34%	8.1
9	6.21%	9.4
10	7.09%	10.7

Below is a comparison of various betting schedules against the recommended betting schedule C. Notice in the chart below, table departure occurs if true count < -1.[5]

[5] A short simulation (not shown) of approximately 500 six deck, 4.5 deck dealt shoes found that table departure (true count < -1 before true count >= 2) occurred on approximately 60% of the back counted shoes and table entry (true count >= 2 before true count < -1) occurred on approximately 40% of the back counted shoes (one of the 500 shoes had neither table entry nor table departure, i.e. -1 =< true count < 2 throughout the entire shoe). Of the 60% table departure shoes, 20% of those shoes eventually became playable (true count >= 2 after true count < -1). So 80% of the time when departing a table (true count < -1) the shoe never becomes playable. Better to abandon your invested time in back counting a shoe with true count < -1 which has only a 20% chance of ever becoming playable (and if it does, you probably will not have many hands to play before cut card comes out) and start back counting a new shoe which has a 40% chance of becoming playable.

Day Trip: 200 hands played (756 hands back counted)

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
(Modified from Exhibit F1c, Truing the Red 7 count)

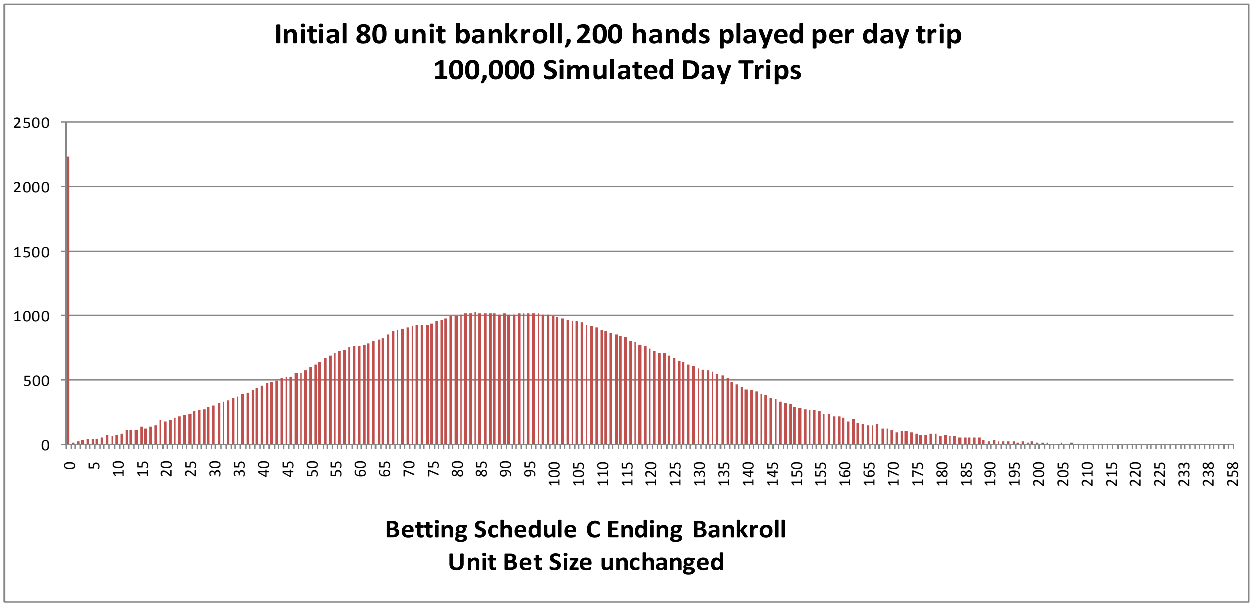
			Number of Hands Back Counted			756			
		Betting Schedule, Units Bet							
Red 7 "tc"	tot adv	A	B	C	D	A'	B'	C'	D'
-1	-0.90%	0	0	0	0	0	0	0	0
0	-0.40%	0	0	0	0	0	0	0	0
1	0.09%	0	0	0	0	0	0	0	0
2	0.66%	1	1	1	1	0	0	0	0
3	1.21%	1	1	2	2	1	1	1	1
4	1.90%	1	2	3	3	1	2	2	2
5	2.71%	1	2	4	4	1	2	3	3
6	3.59%	1	2	4	5	1	2	4	4
7	4.46%	1	2	4	6	1	2	4	5
8	5.34%	1	2	4	7	1	2	4	6
9	6.21%	1	2	4	8	1	2	4	7
10	7.09%	1	2	4	9	1	2	4	8
# hands played		200	200	200	200	114	114	114	114
Amount Bet		226	298	466	510	129	201	263	284
• = Expected Win		3.4	5.5	9.7	11.9	2.8	4.8	7.3	8.5
% adv = E(win) / Bet		1.5%	1.8%	2.1%	2.3%	2.1%	2.4%	2.8%	3.0%
• = Std Dev		16.6	23.2	39.0	45.6	12.5	20.5	29.2	33.4

A day trip is defined as 8 hours of play with an average of 25 hands played per hour or a total of 200 hands played. If 756 hands are back counted, then, on average 200 hands are played at true count >= 2.

The purpose of this chart is to show the reader some of the various betting schedule results so reader can decide if he would like to depart from the recommended betting schedule C and the reader can also compare the advantages and disadvantages of each betting schedule.

Suppose a player was risk averse and so wished to reduce his risk to a minimum. Instead of the recommended one to four betting schedule C, he could use flat betting schedule A' where no bets are made a true counts below 3 and one unit is bet at all true counts of 3 or more. For the six deck game at the three deck dealt level, that means that nothing is bet at Red 7 running counts below 15 and one unit is bet at Red 7 running counts of 15 or more. Both betting schedules have the same 2.1% player advantage and betting schedule A' has a standard deviation of only 12.5 units as compared to betting schedule C which has a standard deviation of 39.0 units. So betting schedule A' is less risky than betting schedule C but this reduced risk comes with a huge price tag - betting schedule A' plays only 114 of the 756 back counted hands with an expected win of only 2.8 units as compared to 200 back counted hands played with an expected win of 9.7 units with betting schedule C.

Below is a graph of the results of a 100,000 day trip simulation where each day trips consisted of 200 hands played with an initial bank of 80 units.



The graph above was originally shown in Exhibit F1c of *Truing the Red 7 count* paper. One to four betting schedule C was used with unit bet sized unchanged (regardless of current bankroll). Expected Profit = Mean Ending Bank - Initial Bank and the probability of a losing trip is given by Prob (Losing Trip) = Prob (Ending Bankroll < Initial Bankroll).

The mean ending bankroll from simulation was 89.45 so the expected profit per day trip is 89.45 - 80 = 9.45 units. The standard deviation of this 200 hand played day trip was 38.8 units. Of the 100,000 simulated day trips, 2,237 resulted in the player losing his entire bankroll giving a risk of ruin of approximately 2.2% and 39,816 day trips had ending bankrolls of less than 80 units giving the probability of a losing trip of approximately 40%.

Maximum bet of 4 units, day trip betting schedule C, shown previously, has an expected win of 9.7 units and a standard deviation of 39.0 units. This compares with the 100,000 day trip simulation results of a win of 9.45 units and a standard deviation of 38.8 units. Theory and simulation results are in close agreement.

The chart below compares betting schedules C, C' with a maximum bet of 4 units to the same betting schedules with a maximum bet of 5 units.

Day Trip: 200 hands played (756 hands back counted)

		Maximum Bet of 4 units compared to Maximum Bet of 5 units			
			Number of Hands Back Coun		756
		Betting Schedule, Units Bet			
		Maximum Bet = 4 units		Maximum Bet = 5 units	
Red 7 "tc"	tot adv	C4	C4'	C5	C5'
-1	-0.90%	0	0	0	0
0	-0.40%	0	0	0	0
1	0.09%	0	0	0	0
2	0.66%	1	0	1	0
3	1.21%	2	1	2	1
4	1.90%	3	2	3	2
5	2.71%	4	3	4	3
6	3.59%	4	4	5	4
7	4.46%	4	4	5	5
8	5.34%	4	4	5	5
9	6.21%	4	4	5	5
10	7.09%	4	4	5	5
# hands played		200	114	200	114
Amount Bet		466	263	489	275
• = Expected Win		9.7	7.3	10.7	7.9
% adv = E(win) / Bet		2.1%	2.8%	2.2%	2.9%
• = Std Dev		39.0	29.2	42.0	31.3

For a maximum bet of 4 units, betting schedule C4' has a player advantage of 2.8% with a standard deviation of 29.2 units as compared to betting schedule C4 which has a player advantage of 2.1% and a standard deviation of 39.0 units. So betting schedule C4' has a larger player advantage and a smaller risk as measured by standard deviation. The price tag for betting schedule C4' is an expected win of 7.3 units as opposed to 9.7 units for betting schedule C4. So waiting till a true count >= 3 to enter the game is too costly in terms of lost expected win. Betting schedule C4 should be used with a one unit table entry bet at Red 7 true count of 2 which is a Red 7 running count of 12 for the six deck game.

With betting schedules C5 and C5' the maximum bet is increased to 5 units which occurs at true counts >= 6. Betting schedule C5 has an expected win of 10.7 units as compared to schedule C4 which has an expected win of 9.7 units and the player's advantage with betting schedule C5 is 2.2% as compared with 2.1% for betting schedule C4. The only cost to betting schedule C5 is that the standard deviation is 42.0 units as compared to a standard deviation of 39.0 units for betting schedule C4. For a day trip with an initial bankroll of 80 units, betting schedule C4 is the suggested starting betting schedule and if the bankroll increases to over 90 units, then betting schedule C5 is suggested. This is covered in more detail later in this paper where various betting schedules are selected (with various maximum bets) based on the size of the current bankroll.

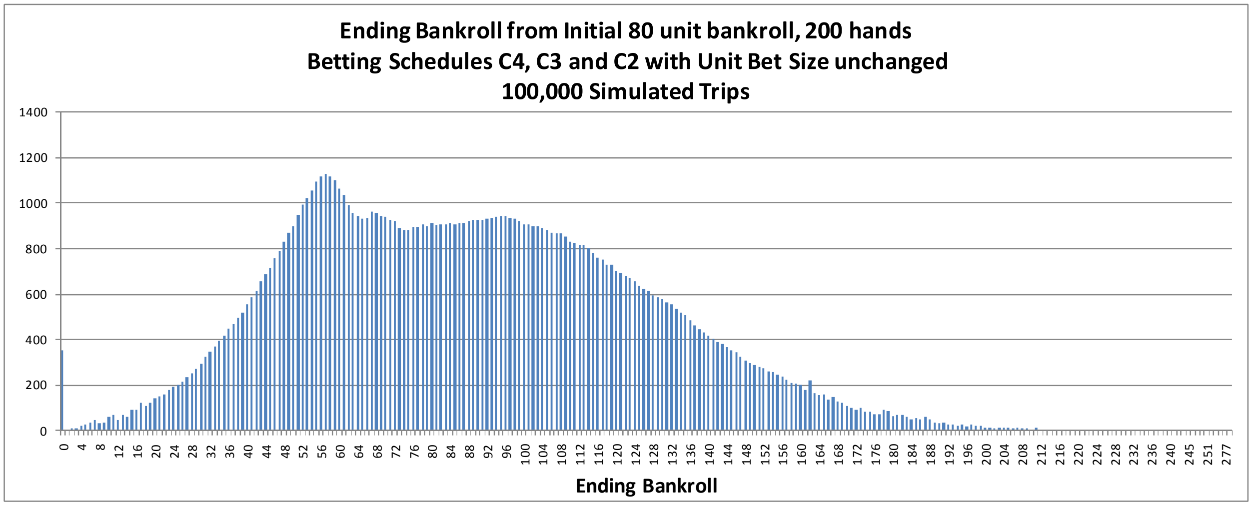
The 100,000 day trip simulation mentioned previously was analyzed to see just how long a losing streak can last. The longest losing streak (ending day trip (200 hands played) bankroll was less than 80 units) was 13 straight day trip loses in a row with a total loss of 248 units before a day trip win finally occurred and it wasn't until day trip number 74 before this 248 unit loss was finally recovered and resulted in a net profit. So in this worst case situation a total of 73 day trips occurred with overall net loss until the 74th day trip finally resulted in a net profit. Exhibit 4D shows the details of this longest 13 day trip in a row losing streak followed by 60 more day trips until finally on the 61st subsequent day trip a net profit was recorded.

The 80 unit initial day trip Risk of Ruin (chance of losing the entire initial bankroll) when the size of the units bets were not changed and the maximum bet of 4 units was not changed, was shown from this 100,000 day trip simulation earlier in this paper and also in *Exhibit F1c* in the *Truing the Red 7 count* paper as 2.2%. The Risk of Ruin formula for an 80 unit bankroll with no change in the size of the unit bet and no reduction in the maximum bet of 4 units was calculated in *Truing the Red 7 count* paper, using the Risk of Ruin formula as 2.4%. The Risk of Ruin formula is shown in Exhibit 4F of this paper and the algorithm for ending bankroll simulation is shown in Exhibit F1c of the *Truing the Red 7* paper and an approximate version is shown in Exhibit 4G of this paper. The 2.2% simulated Risk of Ruin from this simulation was from Exhibit F1c of the *Truing the Red 7* paper and is correct. The theoretical Risk of Ruin is based on a continuous model and so slightly overestimates the actual Risk of Ruin which has discrete values which the simulation in Exhibit F1c of *Truing the Red 7* paper accounts for.

An approximate version of the algorithm in Exhibit F1c of *Truing the Red 7* paper was used in Exhibit 4G of this paper for the other simulations where the size of the bankroll was taken into account in determining the bet size. The footnote to Exhibit 4G explains that the simulation results produced by Exhibit 4G only recorded the ending bankroll and why this resulted in the simulation *slightly* underestimating the actual Risk of Ruin. Exhibit 4G simulations were used for the 80 unit starting bankroll with the betting schedules that reflected the size of the current bankroll and so reduced the 2.2% risk of ruin of the unmodified betting schedule above with the one to four bet spread unchanged regardless of the size of the current bankroll – with such small Risk of Ruins (under 1%), the approximation of using just the ending bankroll, although not correct, produced only a *slight* underestimate in the actual Risk of Ruin as stated above.

The Risk of Ruin and large negative fluctuations, as shown above, can be substantially reduced by decreasing the maximum bet size during losing streaks. During a losing streak, a conservative player will reduce the size of his maximum bet, regardless of the size of his current bankroll or true count, so even if he currently has a net profit and a large true count, he will still reduce the size of his maximum bet. It should be obvious that large losses occur when multiple maximum bets are lost in a row. A high count is no protection from negative fluctuations. So to guard against multiple maximum bet losses, the maximum bet should be decreased during a losing streak. Bankroll and, if winning, profit protection, should be the primary concern. During a losing streak it is much easier to recover from the loss of multiple medium size bets than from a loss of multiple maximum bets. So reduce the bet spread from 1 to 4 to 1 to 3 and finally to 1 to 2 units during a losing streak.

Below is a graph from *Truing the Red 7 count* paper that shows the ending day trip bankroll distribution if the bet spread is decreased as the bankroll decreases.



Notice that now only 352 of the 100,000 simulated day trips resulted in losing the entire initial 80 unit bankroll as compared to 2,237 which occurred when the size of the unit bet was unchanged and the maximum bet of 4 units was unchanged throughout the entire day trip, regardless of the size of the current bankroll.

The method of decreasing the maximum bet size that produced this distribution is as follows:

	Initial Bank = 80 units			
	Red 7 True Count			
Bet Sch	2	3	4	>= 5
C4	1	2	3	4
C3	1	2	3	3
C2	1	2	2	2

Betting Schedule C4:	Betting Schedule C3:
(Current Bank) > 72 units	60 units < (Cur Bank) <= 72 units
Betting Schedule C2:	
(Current Bank) <= 60 units	

Thus as the current bankroll decreases, the maximum bet is reduced from 4 to 3 and finally to 2 units. Notice how quickly the maximum bet size is reduced during a losing streak. For example, if you have two four unit maximum bets out with a bankroll of 80 units and you lost both bets, your bankroll is now at 72 units and your maximum bet should now be 3 units, i.e. you lost two maximum bets in a row and your maximum bet size is already reduced! If a one to five bet spread was chosen, as mentioned as a possibility earlier in this paper, I would be even quicker to reduce the maximum bet of 5 units during a losing streak. So for a one to five initial bet spread of say $25 to $125 dollars, I would quickly reduce the spread to $25 to $100 and then more gradually reduce the spread to $25 to $75 and finally $25 to $50 during a prolonged losing streak.

My suggested day trip betting schedules, also shown in Exhibit 4E, varies with the size of your current bankroll. Your initial bankroll for a day trip is 80 units.

Suggested Day Trip Betting Schedule			
Initial Bankroll = 80 units			
Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 90	C5	5 units	6
72 < B <= 90	C4	4 units	5
60 < B <= 72	C3	3 units	4
B <= 60	C2	2 units	3

Notice that with an initial bankroll of 80 units your initial maximum bet is 4 units. If your bankroll then increases to over 90 units, then the maximum bet of 5 units can be made at true counts of 6 or more. But if your bankroll falls to 90 units or below, your maximum bet should be reduced to 4 units again. If your bankroll continues to fall below 72 units, then your maximum bet becomes 3 units and a current bankroll below 60 units gives a maximum bet of 2 units. As your bankroll fluctuates, your maximum bets will fluctuate between 2 and 5 units

Day Trip: 200 hands played					
	Number of Hands Back Counted			756	
Six Decks, 4.5 decks dealt		Betting Schedule, Units Bet			
Red 7 "tc"	tot adv	C2	C3	C4	C5
-1	-0.90%	0	0	0	0
0	-0.40%	0	0	0	0
1	0.09%	0	0	0	0
2	0.66%	1	1	1	1
3	1.21%	2	2	2	2
4	1.90%	2	3	3	3
5	2.71%	2	3	4	4
6	3.59%	2	3	4	5
7	4.46%	2	3	4	5
8	5.34%	2	3	4	5
9	6.21%	2	3	4	5
10	7.09%	2	3	4	5
# hands played		200	200	200	200
Amount Bet		354	426	466	489
• = Expected Win		6.2	8.2	9.7	10.7
% adv = E(win) / Bet		1.7%	1.9%	2.1%	2.2%
• = Std Dev		27.3	34.4	39.0	42.0

The reduction in the maximum bet size as the current bankroll decreases, can be interpolated, similar to interpolation of the number of units to bet for Red 7 running counts in-between 12, 15, 18 and 21 for the six deck game at the thee deck dealt level as discussed earlier in this paper. So if your current bankroll is 80 units then your maximum bet is 4 units. If you lose two maximum bets in a row, your current bankroll is now 72 units and your maximum bet should be 3 units. If you lose another two more maximum bets in a row (maximum bet is now 3 units) then your current bankroll will now be 66 units. A 60 unit bankroll has a maximum bet of 2 units and a 72 unit bankroll has a maximum bet of 3 units so a 66 unit bankroll can be interpolated to have a maximum bet of 2.5 units. Thus if the unit bet size were $25 the initial 80 unit bankroll maximum bet was $100. Losing two $100 bets in a row puts the new maximum bet at $75. Losing another two maximum bets (now $75) in a row should reduce the maximum bet to $60 or $65 and if another two maximum bets (now $60 or $65) in a row are lost then reduce the maximum bet to $50 where your maximum bet stays until either your bankroll recovers so that your maximum bet can be increased again, you tap out (go bankrupt) or your day trip ends. These bet reductions and calculations do not have to be exact but the general trend in the reduction of the current bankroll should be recognized and rather than discontinuous step reductions in the maximum bet size, the maximum bet size can be reduced in a smoother and more continuous manner as described above. As mentioned earlier, the conservative player may implement these maximum bet reductions during a losing streak regardless of the size of his current bankroll, protection of bankroll and profits being his primary concern. Notice that this is just the opposite of "steaming" where bets are raised during a losing streak (counter feeling that a high count will protect him from losses) in an attempt to win back what was just lost.

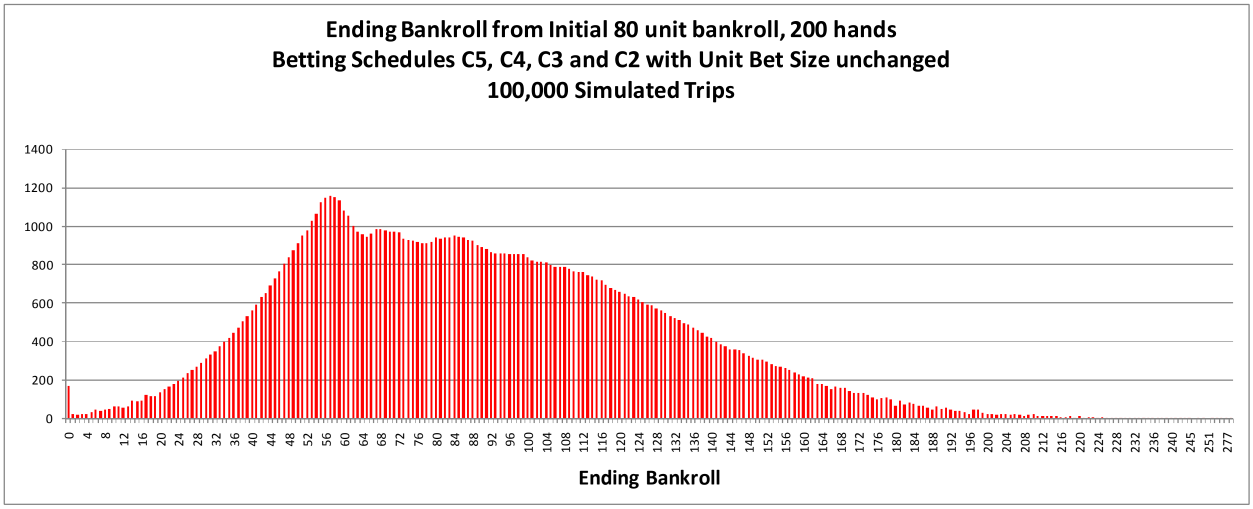
Suggested Bet, in units

Day Trip: 200 hands played					
Six Decks at the Three Deck Dealt Level					
Initial Bankroll = 80 units		B = Current Bankroll			
Red 7		C2	C3	C4	C5
run count	true count[1]	B <= 60	60 < B <= 72	72 < B <= 90	B > 90
12	2.0	1.0	1.0	1.0	1.0
13	2.3	1.5	1.5	1.5	1.5
14	2.7	1.5	1.5	1.5	1.5
15	3.0	2.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5	2.5
17	3.7	2.0	2.5	2.5	2.5
18	4.0	2.0	3.0	3.0	3.0
19	4.3	2.0	3.0	3.5	3.5
20	4.7	2.0	3.0	3.5	3.5
21	5.0	2.0	3.0	4.0	4.0
22	5.3	2.0	3.0	4.0	4.5
23	5.7	2.0	3.0	4.0	4.5
>= 24	>= 6	2.0	3.0	4.0	5.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

So these suggested betting schedules ramp your maximum bet up to 5 units at true counts >= 6 when winning and quickly drop your maximum bet to as little as 2 units at true counts >= 3 during a losing streak. The graph below shows an ending bankroll distribution from switching between betting schedules C2, C3, C4 and C5 as the size of your current bankroll changes, as described above.

Below are the results from a simulation of 100,000 day trips from Exhibit 4H. The algorithm that produced these results is shown in Exhibit 4G.



The method of decreasing the maximum bet size that produced this distribution is as follows:

	Initial Bank = 80 units				
	Red 7 True Count				
Bet Sch	2	3	4	5	>=6
C5	1	2	3	4	5
C4	1	2	3	4	4
C3	1	2	3	3	3
C2	1	2	2	2	2

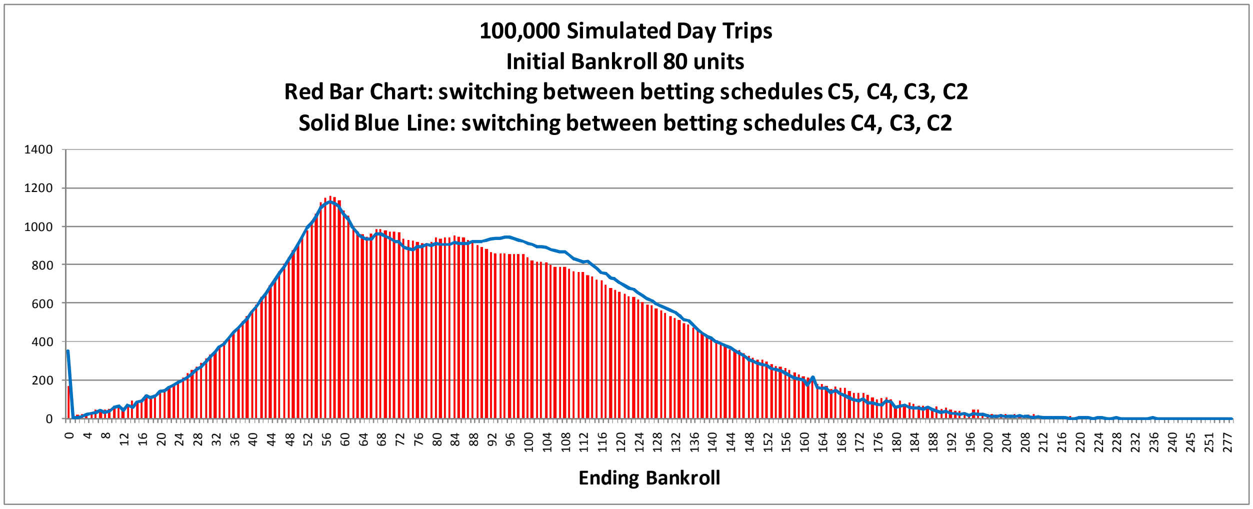
Betting Schedule C5:	Betting Schedule C4:
(Current Bank) > 90 units	72 units < (Current Bank) <= 90 units
Betting Schedule C3:	Betting Schedule C2:
60 units < (Cur Bank) <= 72 units	(Current Bank) <= 60 units

Comparison of results from adding betting schedule C5 are shown below and in Exhibit 4H.

Betting Schedule Comparisons

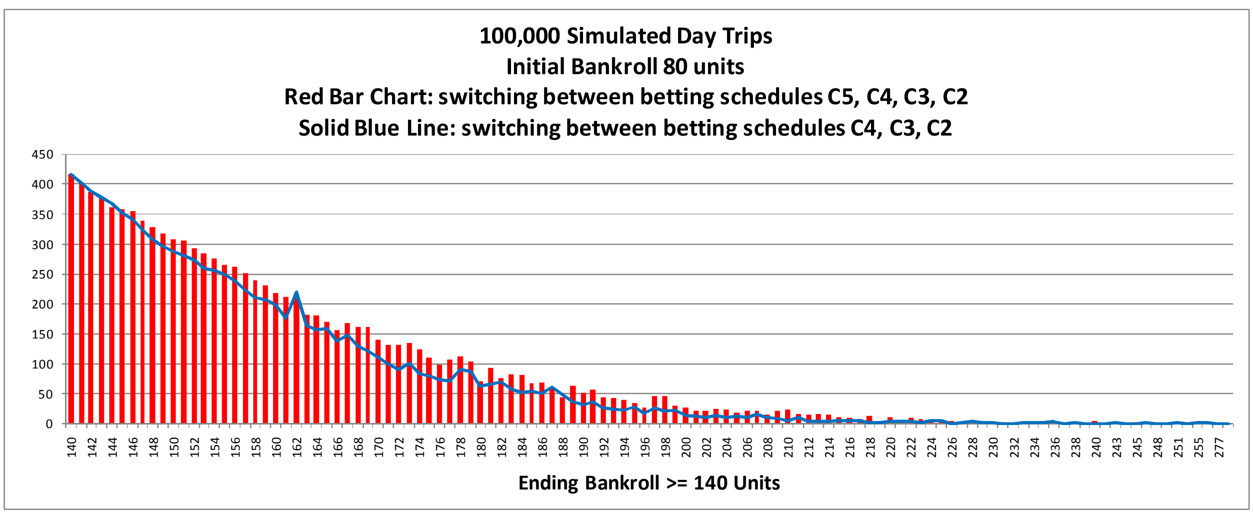
#1: Switching betting schedules C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 5 units at true counts >= 6 when day trip bankroll > 90 units
#2: Switching betting schedules C4, C3 and C2 based on size of curent bankroll
#3: Constant 1-4 bet spread, irrespective of size of current bankroll.

100,000 day trip simulation:	#1	#2	#3	#1 has fewer medium size wins and more extreme large wins than #2
				Betting #1 compared to Betting #2
Number of Day Trips ending in bankruptcy	169	352	2,237	(1) #1 has a lower risk of ruin
Mean	89.1	88.6	89.5	(2) #1 has a higher expected win
Standard Deviation	38.5	37.1	38.9	(3) #1 has a slightly higher standard deviation
Skew	0.446	0.334	0.007	(4) #1 is more highly skewed to the right (longer right tail):
Kurtosis *	-0.132	-0.271	-0.025	#1 has less ending bankrolls in the 90 to 140 range but
* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.				more ending bankrolls over 150 units.

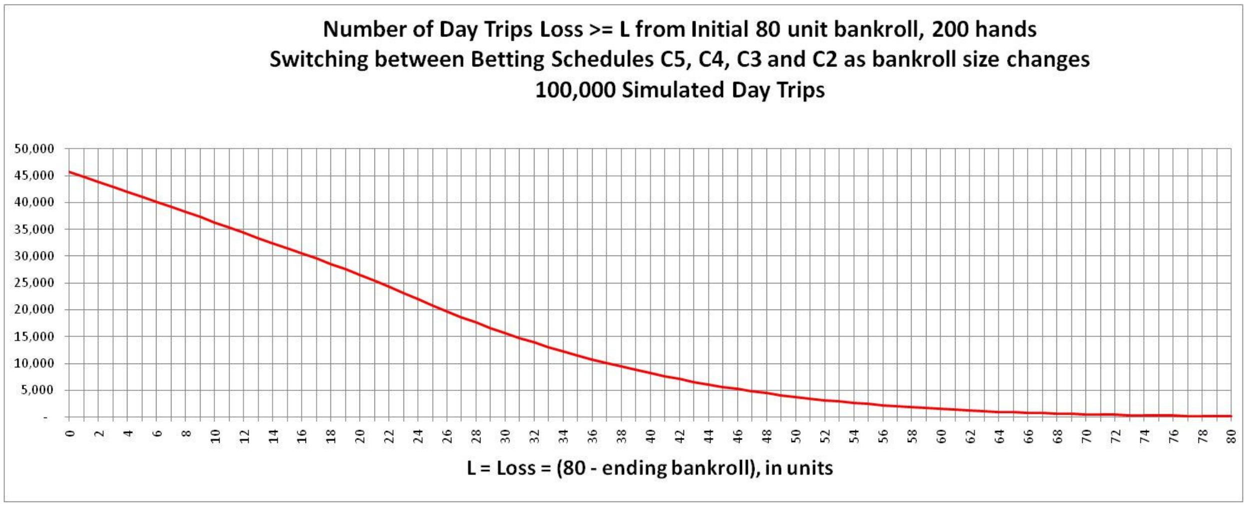


By adding betting schedule C5 to betting schedules C4, C3 and C2, the expected win is increased 0.5 units from 8.6 to 9.1 (ending bankroll increased from 88.6 to 89.1 with initial bankroll being 80 units) and the number of bankruptcies is decreased by 183 from 352 to 169 with the standard deviation increasing 1.4 units from 37.1 to 38.5. The increase in the standard deviation is of no concern here since the increase in the skew, $E(X - \mu)^3 / \sigma^3$, from 0.334 to 0.446, which represents a larger tail at the right (more frequent larger wins), caused the increased standard deviation.

Below is a close up for ending bankrolls of 140 units or more. From this close up view, it is clear that adding C5 to the switching betting schedules gives more extreme ending bankrolls.



From the graph below, the probability of the ending day loss, in units, being greater than or equal to “L” can be calculated.



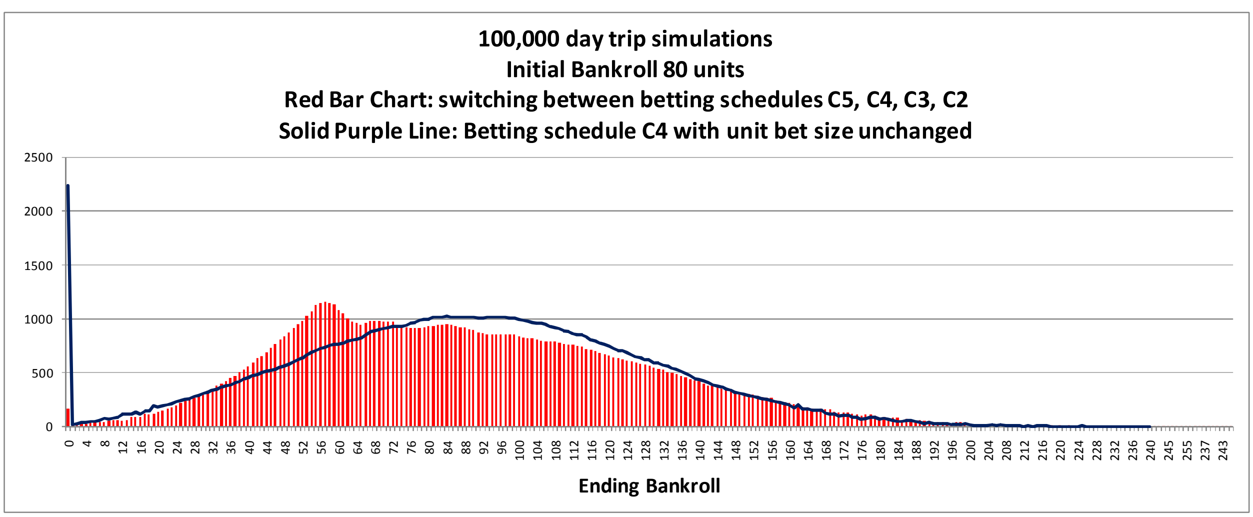
Some examples from reading the graph above:

(1) Prob(Losing Trip) = Prob(Loss > 0 units) = Prob(Loss >= 1 unit) ≈ 45,000 out of 100,000 day trips so Prob(Losing Trip) ≈ 45%.

(2) Question: On a particular day trip, with a unit bet of $25 and switching between betting schedules C5, C4, C3 and C2, as described above, the loss for the day trip was $1,100. How likely was a loss of $1,100 or more using this system?

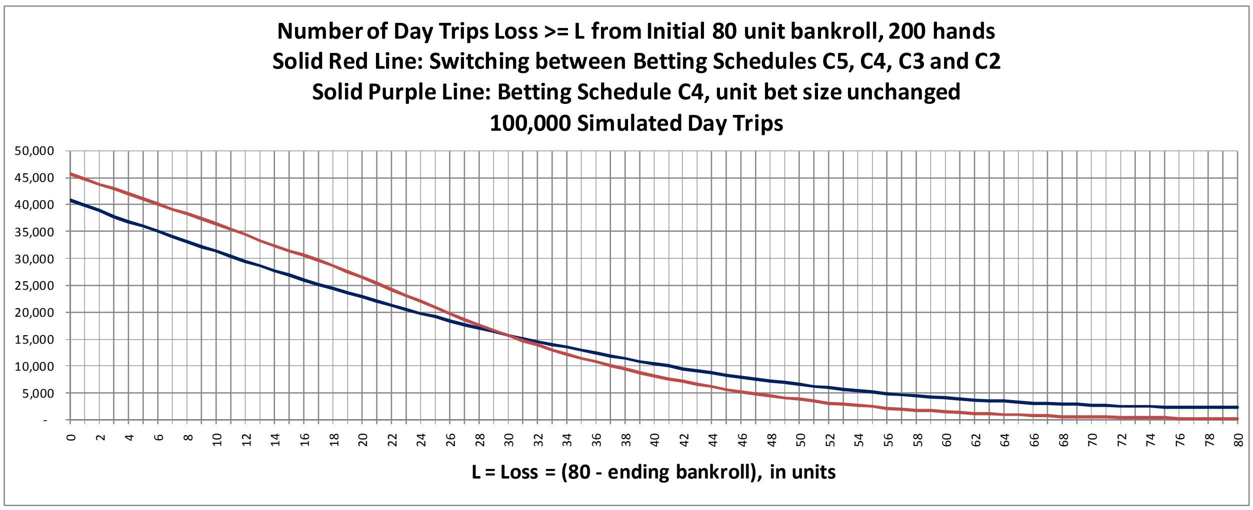
Answer: A loss of $1,100 with a unit bet of $25 is a loss of 44 units. Losing 44 units or more occurs approximately 6,000 times out of 100,000 day trips. So the chance of losing $1,100 or more in a day trip is the chance of losing 44 units or more which is approximately 6%.

The graph below shows Betting Schedule C4 superimposed on switching between betting schedules C5, C4, C3 and C2 based on the size of the current bankroll.



Notice that betting schedule C4's risk of ruin of over 2,237 out of 100,000 day trips has been reduced to 169 day trips ruined by switching betting schedules with the size of the current bankroll and the total loss of the bankroll, ending bankroll equal to zero, has been replaced by a high frequency of ending bankroll's around 50 or 60 units which represents 20 or 30 units out of the initial 80 units bankroll lost.

The graph below further illustrates this. As can be seen, approximately 45,000 day trips (45%) end in a losing session for the switching betting schedule as opposed to around 40,000 day trips (40%) losing sessions for betting schedule C4. Also for all losses less than 30 units, the switching betting schedule has a higher chance of these losses occurring than betting schedule C4. For losses greater than 30 units, the switching betting schedule has fewer losses than the fixed betting schedule C4. So the switching betting schedule has more small losses (less than 30 units) and fewer large losses (greater than 30 units) than the fixed betting schedule C4.



Calculation of Red 7 True Count Frequencies for hands played (true count >= 2)						
(A)	(B)	(C)	(C)	(D)	(E)	(F)
	tc >= -1		tc >= 2			
Red 7 "tc"	Hand %	Hand Frequency	Hand Frequency	Hand %	Red 7 "tc"	Hand %
-1	20.8%	208				
0	32.0%	320				
1	20.7%	207				
2	11.4%	114	114	43.0%	2	43.0%
3	6.6%	66	66	24.9%	3	24.9%
4	3.8%	38	38	14.3%	4	14.3%
5	2.1%	21	21	7.9%	5	7.9%
6	1.2%	12	12	4.5%	>= 6	9.8%
7	0.7%	7	7	2.6%		
8	0.4%	4	4	1.5%		
9	0.2%	2	2	0.8%		
10	0.1%	1	1	0.4%		
Total	100.0%	1,000	265	100.0%	Total	100.0%

Shown above is a calculation of Red 7 true count frequencies for the hands actually played, i.e. true count frequencies given that the Red 7 true count is greater than or equal to 2. Betting Schedule C5 recommends a bet of 5 units a Red 7 true counts >= 6 which would correspond to a Red 7 running count of 24 or more for the six deck game at the three deck dealt level. The chart below shows that 9.8% of the back counted hands (Red 7 true count >= 2) have Red 7 true counts greater than or equal to 6.

The weighted average total player advantage for Red 7 true count >= 6 is approximately 4.5%.

Calculation of Player's Total Advantage for tc >= 6			
4.5 out of 6 decks dealt			
	(1)	(2)	(3) = (1)*(2)
Red 7 tc	tot adv	Hand %	
6	3.59%	4.5%	0.16%
7	4.46%	2.6%	0.12%
8	5.34%	1.5%	0.08%
9	6.21%	0.8%	0.05%
10	7.09%	0.4%	0.03%
Total		9.8%	0.44%
(Wghtd Avg tot adv at tc >= 6) = Tot(3) / Tot(2) =			4.45%

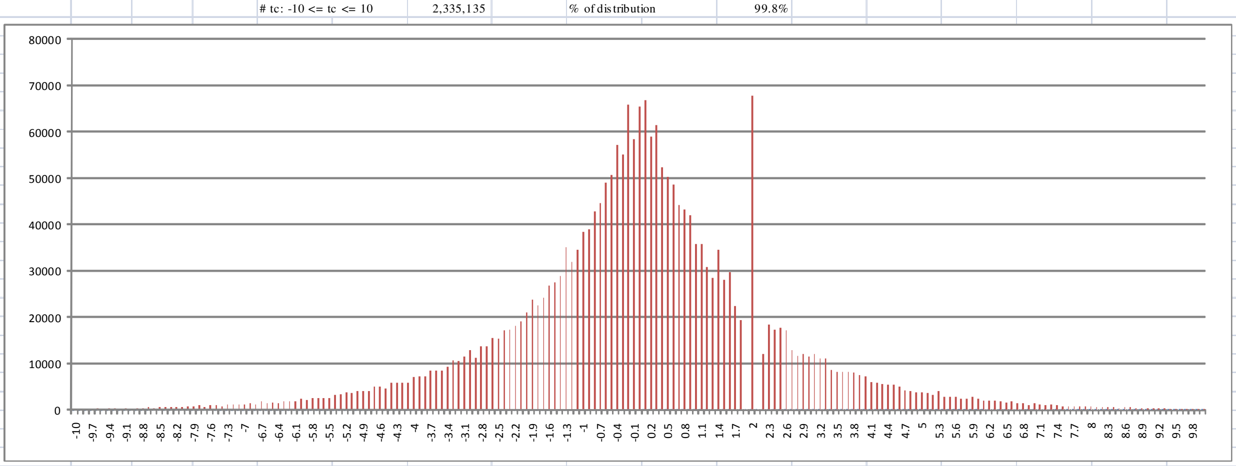
In the *Truing the Red 7 count* paper it was shown that the Red 7 true count frequency distribution is leptokurtic. This means that the Red 7 true count tail is fatter than the tail a normal distribution would predict for true counts of 6 or more, thus 9.8% of the hands played (Red 7 true count >= 2) were at Red 7 true count >= 6 which would be a 5 unit bet if using betting schedule C5.

Below is a graph of the Red 7 true count distribution.

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%	



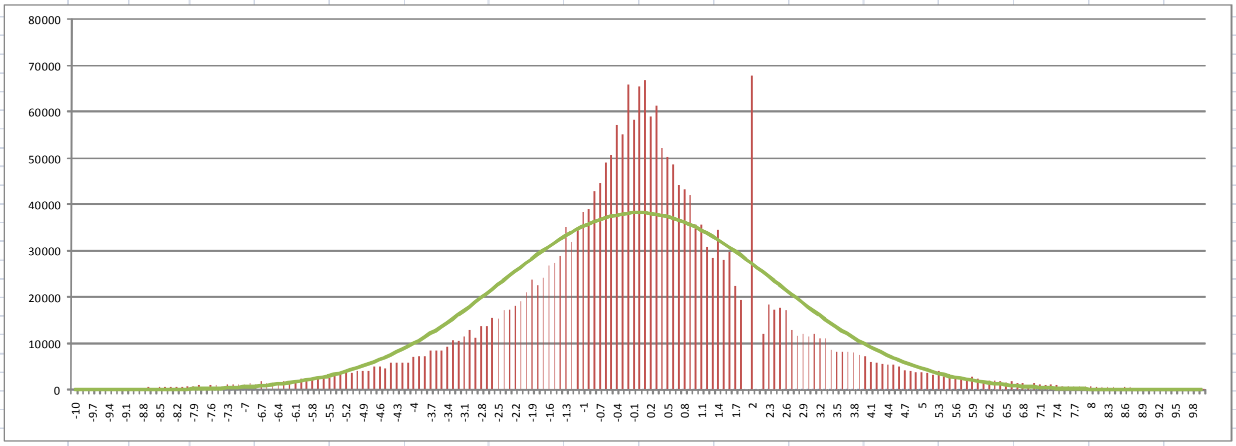
The Red 7 true count frequency distribution is leptokurtic. The distribution can be thought of as being constructed from the Normal Distribution by "squeezing" the Normal Distribution between -2 and -5 and between +2 and +5 and the displaced frequencies "popping up" between -1 and +1 and "spread out" at greater than or equal to +6 and less than or equal to -6.

Below is a graph of the Red 7 true count distribution compared with its normal approximation.

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%	

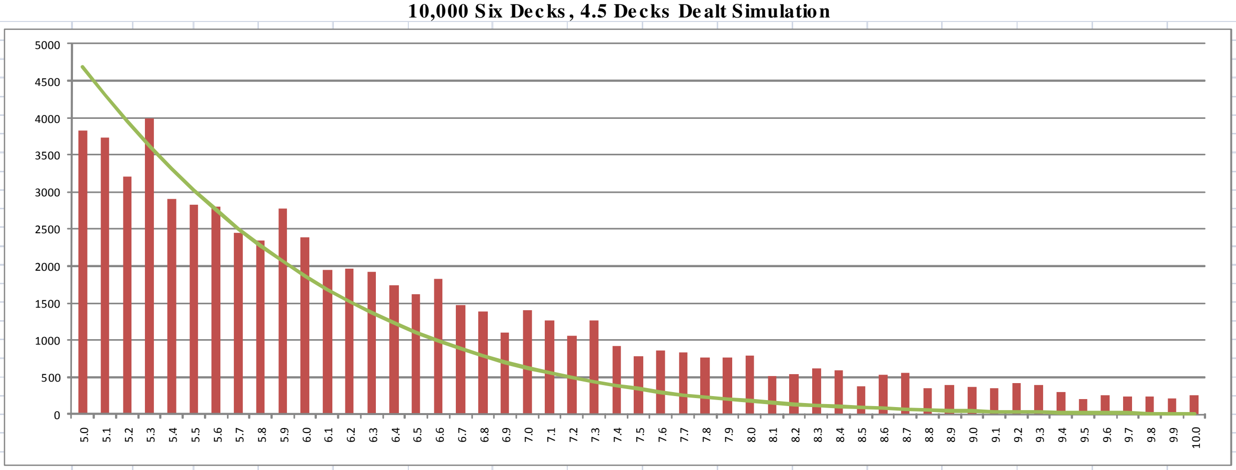


The Red 7 true count distribution above has a mean of zero, standard deviation of 2.44, skew of essentially zero and kurtosis of 5.39 (normal distribution has a kurtosis of 3.0). The normal distribution is defined by only two parameters, the mean and standard deviation. To demonstrate the Red 7 true count distribution departure from the normal distribution, I have superimposed on this Red 7 true count distribution above, a normal distribution with a mean of zero and a standard deviation of 2.44, shown by the solid green line in the graph below.

The graph comparing the Red 7 true count distribution with its normal approximation should clarify that the normal distribution underestimates the Red 7 true count distribution for Red 7 true counts approximately between -1 and +1 and for Red 7 true counts between 1 and 6 and between -1 and -6, the normal distribution overestimates the Red 7 true count distribution. For Red 7 true counts < - 6 and Red 7 true counts > 6 the normal distribution again underestimates the Red 7 true count distribution as shown in the graph below. Below is a close up of Red 7 true count distribution for Red 7 true counts >= 5 and the normal approximation which is shown by the solid green line. Here it can be clearly seen that the normal distribution underestimates the Red 7 true count frequency distribution for Red 7 true counts >= 6.

Red 7 True Count Frequency Distribution

10,000 Six Decks, 4.5 Decks Dealt Simulation



A slightly more aggressive player may add betting schedule C6 where the maximum bet is now raised to six units which only occurs if he current day trip bankroll is over 100 units (initial bankroll is 80 units) and the Red 7 true count >= 7 (which corresponds to a Red 7 running count of 27 for the six deck game at the three deck dealt level). This is new added betting schedule C6 is shown in the charts below.

Suggested Day Trip Betting Schedules			
Betting Schedules Vary by Size of Current Bankroll			
Betting Schedule C6 added			
with maximum bet of 6 units at true counts >= 7 and Bank > 100 units			
Six Decks, 4.5 decks dealt			
Suggested Day Trip Betting Schedule			
Initial Bankroll = 80 units			
Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 100	C6	6 units	7
90 < B <= 100	C5	5 units	6
72 < B <= 90	C4	4 units	5
60 < B <= 72	C3	3 units	4
B <= 60	C2	2 units	3

Below is the chart of betting schedules C2, C3, C4, C5 and C6 with the initial day trip bankroll of 80 units which means the initial betting schedule is betting schedule C4.

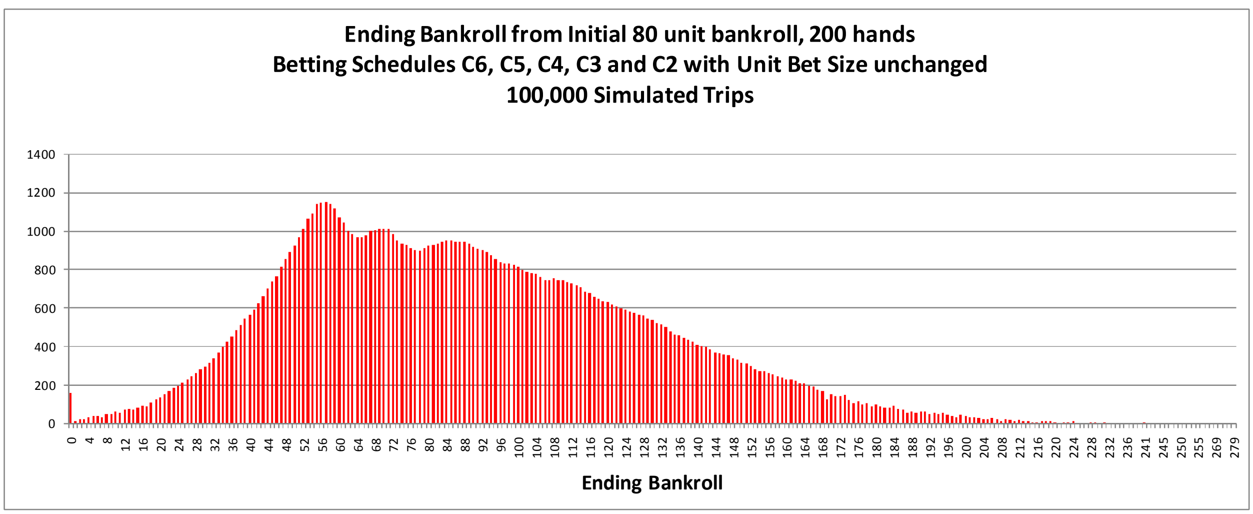
Day Trip: 200 hands played						
	Number of Hands Back Counted			756		
Six Decks, 4.5 decks dealt		Betting Schedule, Units Bet				
Red 7 "tc"	tot adv	C2	C3	C4	C5	C6
-1	-0.90%	0	0	0	0	0
0	-0.40%	0	0	0	0	0
1	0.09%	0	0	0	0	0
2	0.66%	1	1	1	1	1
3	1.21%	2	2	2	2	2
4	1.90%	2	3	3	3	3
5	2.71%	2	3	4	4	4
6	3.59%	2	3	4	5	5
7	4.46%	2	3	4	5	6
8	5.34%	2	3	4	5	6
9	6.21%	2	3	4	5	6
10	7.09%	2	3	4	5	6
# hands played		200	200	200	200	200
Amount Bet		354	426	466	489	501
• = Expected Win		6.2	8.2	9.7	10.7	11.3
% adv = E(win) / Bet		1.7%	1.9%	2.1%	2.2%	2.3%
• = Std Dev		27.3	34.4	39.0	42.0	43.9

Below is how to implement the above betting schedule with the six deck game assumed to be at the three deck dealt level.

Suggested Bet, in units						
Day Trip: 200 hands played						
Six Decks at the Three Deck Dealt Level						
Initial Bankroll = 80 units		B = Current Bankroll				
Red 7		C2	C3	C4	C5	C6
run count	true count[1]	B <= 60	60 < B <= 72	72 < B <= 90	90 < B <= 100	B > 100
12	2.0	1.0	1.0	1.0	1.0	1.0
13	2.3	1.5	1.5	1.5	1.5	1.5
14	2.7	1.5	1.5	1.5	1.5	1.5
15	3.0	2.0	2.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5	2.5	2.5
17	3.7	2.0	2.5	2.5	2.5	2.5
18	4.0	2.0	3.0	3.0	3.0	3.0
19	4.3	2.0	3.0	3.5	3.5	3.5
20	4.7	2.0	3.0	3.5	3.5	3.5
21	5.0	2.0	3.0	4.0	4.0	4.0
22	5.3	2.0	3.0	4.0	4.5	4.5
23	5.7	2.0	3.0	4.0	4.5	4.5
24	6.0	2.0	3.0	4.0	5.0	5.0
25	6.3	2.0	3.0	4.0	5.0	5.5
26	6.7	2.0	3.0	4.0	5.0	5.5
>= 27	>= 7	2.0	3.0	4.0	5.0	6.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

Below is a graph of the ending bankrolls switching between betting schedules C6, C5, C4, C3 and C2 depending on the size of the player's current bankroll as described above.



	Initial Bank = 80 units					
	Red 7 True Count					
Bet Sch	2	3	4	5	6	>=7
C6	1	2	3	4	5	6
C5	1	2	3	4	5	5
C4	1	2	3	4	4	4
C3	1	2	3	3	3	3
C2	1	2	2	2	2	2

Betting Schedule C6:
(Current Bank) > 100 units

Betting Schedule C5:
90 units < (Current Bank) <= 100 units

Betting Schedule C4:
72 units <= (Current Bank) < 90 units

Betting Schedule C3:
60 units < (Cur Bank) <= 72 units

Betting Schedule C2:
(Current Bank) <= 60 units

Comparison of results from adding betting schedule C6 are shown below and in Exhibit 4H. The expected win is increased 0.2 units from 9.1 to 9.3 and the number of bankruptcies is decreased by 7 from 169 to 162 with the standard deviation increasing 0.6 units from 38.5 to 39.1. The increase in the standard deviation is of no concern here since the increase in the skew from 0.446 to 0.498, which represents a larger tail at the right (more frequent larger wins), caused the increased standard deviation.

Betting Schedule Comparisons with Betting Schedule C6 added

#0: Switching betting schedules C6, C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 6 units at true counts >= 7 when day trip bankroll > 100 units

#1: Switching betting schedules C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 5 units at true counts >= 6 when day trip bankroll > 90 units

#2: Switching betting schedules C4, C3 and C2 based on size of curent bankroll

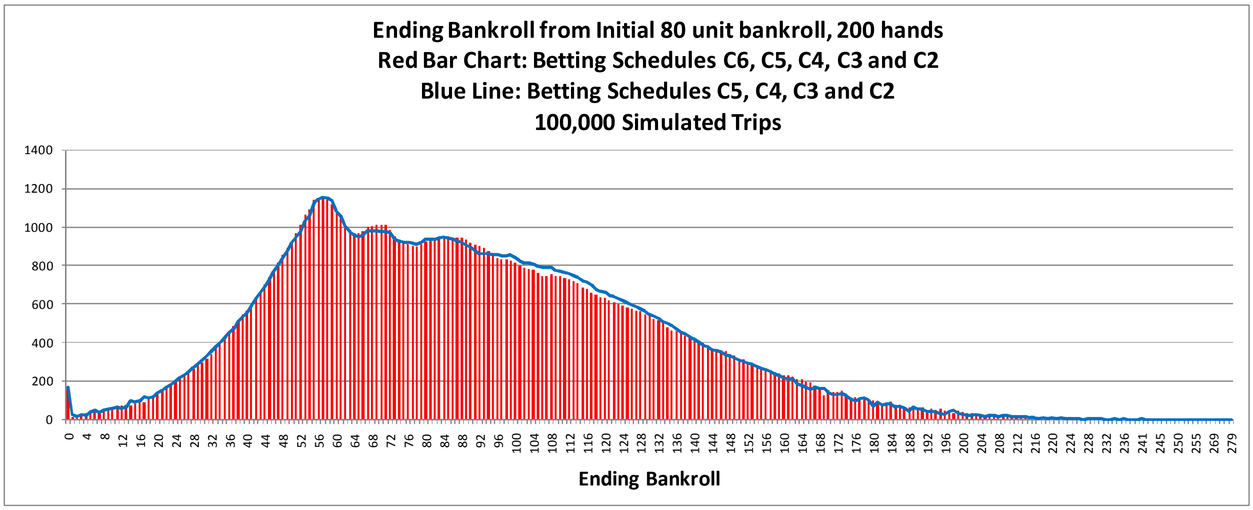
#3: Constant 1-4 bet spread, irrespective of size of current bankroll.

#1 has fewer medium size wins and more extreme large wins than #2

100,000 day trip simulation:	#0	#1	#2	#3
Number of Day Trips ending in bankruptcy	162	169	352	2,237
Mean	89.3	89.1	88.6	89.5
Standard Deviation	39.1	38.5	37.1	38.9
Skew	0.498	0.446	0.334	0.007
Kurtosis *	-0.059	-0.132	-0.271	-0.025

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting #0 compared to Betting #1
(1) #0 has a lower risk of ruin
(2) #0 has a higher expected win
(3) #0 has a slightly higher standard deviation
(4) #0 is more highly skewed to the right (longer right tail):
#0 has less ending bankrolls in the 90 to 140 range but
more ending bankrolls over 150 units.



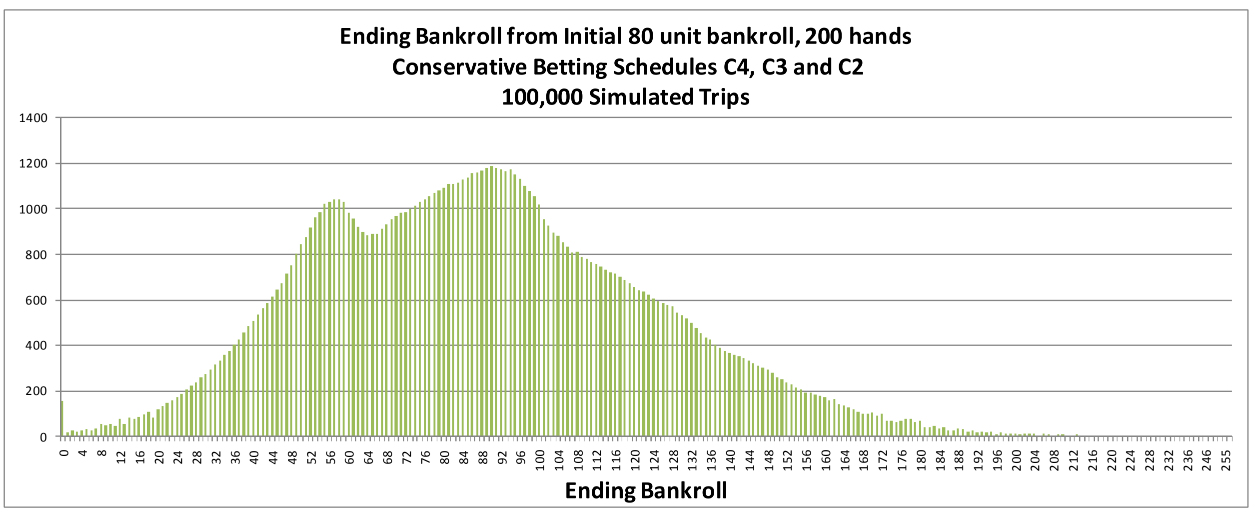
The next betting systems that I will analyze I will call conservative C2-C4 and conservative C2-C6. Conservative C2-C4 is described below. With this system, since your initial bankroll is 80 units, you are starting with betting schedule C3.

Conservative C2-C4 Day Trip Betting Schedule			
Initial Bankroll = 80 units			
Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 100	C4	4 units	5
60 < B <= 100	C3	3 units	4
B <= 60	C2	2 units	3

CONSERVATIVE C2-C4 suggested Bet, in units				
Day Trip: 200 hands played				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = 80 units		B = Current Bankroll		
Red 7		C2	C3	C4
run count	true count[1]	B <= 60	60 < B <= 100	B > 100
12	2.0	1.0	1.0	1.0
13	2.3	1.5	1.5	1.5
14	2.7	1.5	1.5	1.5
15	3.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5
17	3.7	2.0	2.5	2.5
18	4.0	2.0	3.0	3.0
19	4.3	2.0	3.0	3.5
20	4.7	2.0	3.0	3.5
>= 21	>= 5	2.0	3.0	4.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

Below is a graph of the ending bankrolls of the conservative C2-C4[6]. Notice that this ending bankroll distribution has the desirable property that the mean and the mode are approximately equal. The mode of this distribution is an ending bankroll of approximately 88 units which is close to the expected (mean) ending bankroll which is also approximately 88 units and represents a profit over the 80 unit initial bankroll of approximately 8 units.



[6] Exhibit 4H shows the results of a conservative C2-C6 switching betting schedules compared to conservative C2-C4 shown here. Conservative C2-C6 jumps immediately to betting schedule C6, totally bypassing C4 and C5 when the current bankroll is greater than 100 units, and when the bankroll drops to under 100 units it immediately reverts back to betting schedule C3. So when the bankroll is greater than 100 (winning large bets), the maximum bet is six units at true counts >= 7 and when the bankroll falls below 100 (losing a few large bets in a row), the maximum bet is immediately cut in half to 3 units for all true counts >= 4.

	Initial Bank = 80 units							
	Red 7 True Count							
Bet Sch	2	3	4	>= 5	Betting Schedule C4:		Betting Schedule C3:	
C4	1	2	3	4	(Current Bank) > 100 units		60 units < (Cur Bank) <= 100 units	
C3	1	2	3	3	Betting Schedule C2:			
C2	1	2	2	2	(Current Bank) <= 60 units			

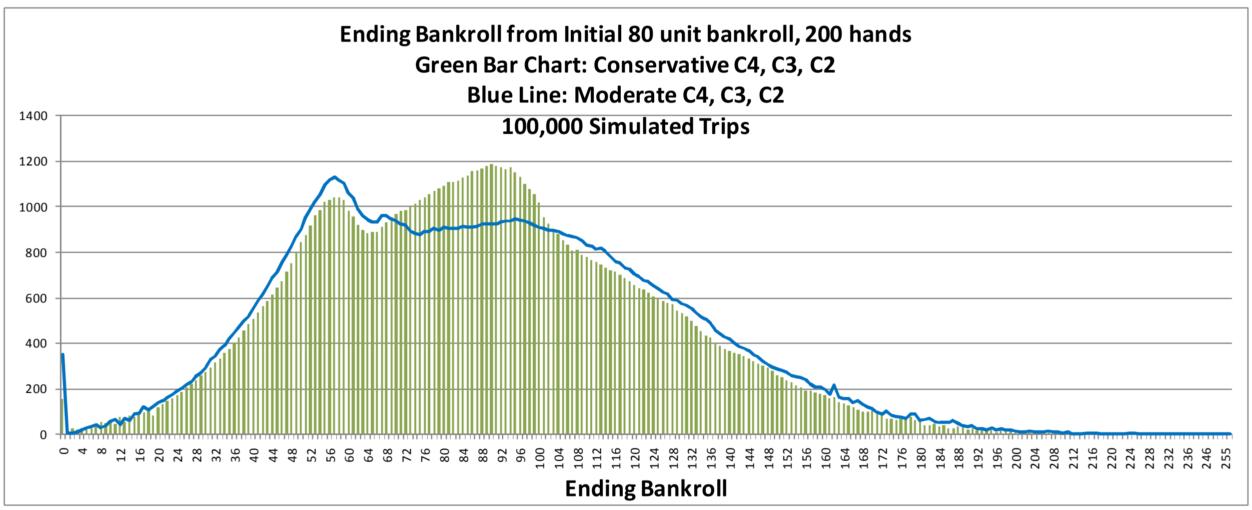
And below is a comparison of the conservative C2-C4 with the moderate C2-C4 which was the first switching betting system analyzed.

Betting Schedule Comparisons Conservative C2-C4 versus Moderate C2-C4

	Initial Bank = 80 units						
	Red 7 True Count					Conservative	Moderate
Bet Sch	2	3	4	>= 5	Betting Schedule C4:	(Cur Bank) > 100	(Cur Bank) > 72
C4	1	2	3	4	Betting Schedule C3:	60 < (Cur Bank) <= 100	60 < (Cur Bank) <= 72
C3	1	2	3	3	Betting Schedule C2:	(Cur Bank) <= 60	(Cur Bank) <= 60
C2	1	2	2	2			

	C2, C3, C4		
100,000 day trip simulation:	Conservative	Moderate	Conservative versus Moderate C2-C4
Number of Day Trips ending in bankruptcy	154	352	(1) Conservative has a lower risk of ruin
Mean	88.1	88.6	(2) Conservative has slightly lower expected win
Standard Deviation	35.0	37.1	(3) Conservative has lower standard deviation
Skew	0.335	0.334	(4) Conservative and Moderate approximately equally skewed to the right.
Kurtosis *	-0.056	-0.271	**Mode of conservative C2-C4 is around 88 units which is also the mean ending bankroll, so a profit of the expected win of 8 units is also the most likely occurrence.**

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.



Notice that with the conservative C2-C4 betting system shown above, your initial bankroll is 80 units so your initial betting schedule is C3 which has a maximum bet of 3 units. The cutoff points of when to switch between the different betting schedules do not have to be exact – the idea is to quickly decrease your maximum bet to 2 units during a losing streak and gradually increase your maximum bet to 4 units during a winning streak. Also, if playing two hands, consider switching to one hand during a losing streak. The conservative C2-C4 betting system responds quickly and in a smooth and continuous manner to changes in bankroll size by changing the size of your maximum bet.

Below is the conservative C2-C6 switching betting system.

Conservative C2-C6			
Initial Bankroll = 80 units			
Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 100	C6	6 units	7
60 < B <= 100	C3	3 units	4
B <= 60	C2	2 units	3

CONSERVATIVE C2-C6 suggested Bet, in units				
Day Trip: 200 hands played				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = 80 units		B = Current Bankroll		
Red 7		C2	C3	C6
run count	true count[1]	B <= 60	60 < B <= 100	B > 100
12	2.0	1.0	1.0	1.0
13	2.3	1.5	1.5	1.5
14	2.7	1.5	1.5	1.5
15	3.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5
17	3.7	2.0	2.5	2.5
18	4.0	2.0	3.0	3.0
19	4.3	2.0	3.0	3.5
20	4.7	2.0	3.0	3.5
21	5.0	2.0	3.0	4.0
22	5.3	2.0	3.0	4.5
23	5.7	2.0	3.0	4.5
24	6.0	2.0	3.0	5.0
25	6.3	2.0	3.0	5.5
26	6.7	2.0	3.0	5.5
>= 27	>= 7	2.0	3.0	6.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

Below are graphs from Exhibit 4H which shows a detailed comparison of the conservative C2-C6 with the conservative C2-C4.

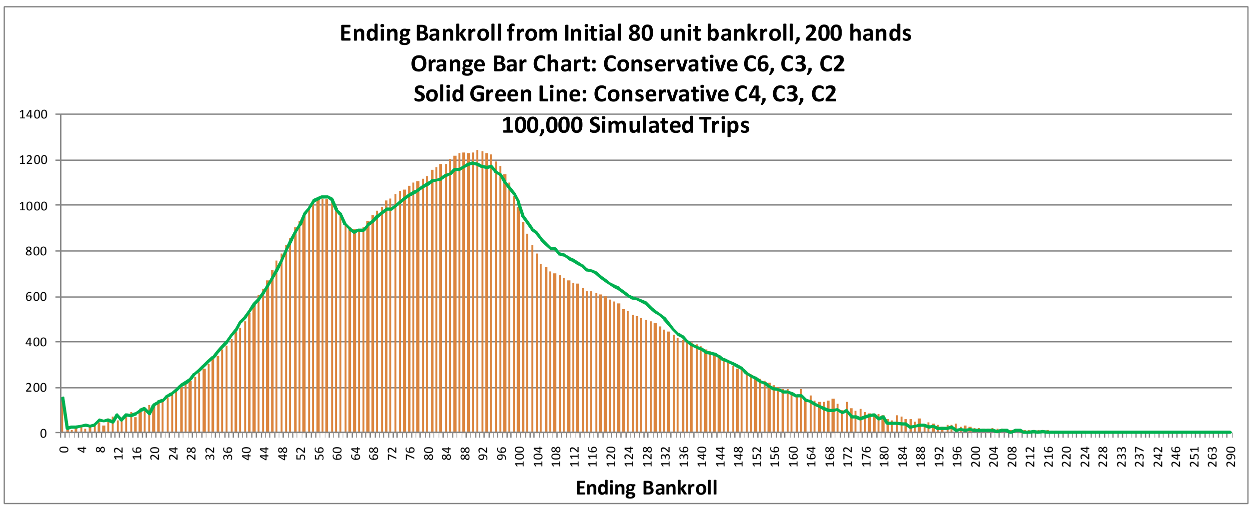
Betting Schedule Comparisons Conservative C2-C6 versus Conservative C2-C4

	Conservative C2-C6		Conservative C2-C4
Betting Schedule C6:	(Cur Bank) > 100	Betting Schedule C4:	(Cur Bank) > 100
Betting Schedule C3:	60 < (Cur Bank) <= 100	Betting Schedule C3:	60 < (Cur Bank) <= 100
Betting Schedule C2:	(Cur Bank) <= 60	Betting Schedule C2:	(Cur Bank) <= 60

	Conservative		
100,000 day trip simulation:	C2-C6	C2-C4	Conservative C2-C6 versus Conservative C2-C4
Number of Day Trips ending in bankruptcy	149	154	(1) C2-C6 has slightly lower risk of ruin
Mean	88.4	88.1	(2) C2-C6 has slightly larger expected win
Standard Deviation	36.2	35.0	(3) C2-C6 has slightly larger standard deviation
Skew	0.510	0.335	(4) C2-C6 is more highly skewed to the right (longer right tail):
Kurtosis *	0.279	-0.056	C2-C6 has less ending bankrolls in the 100 to 140 range but
			more ending bankrolls between 70 and 100 and over 160 units.

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

The algorithm used to simulate one of the ending bankroll distributions (others similar) is shown in Exhibit 4G. Exhibit 4G does not take into account DAS or re-splitting so if either DAS and/or re-splitting is allowed then the frequency of the C2-C6 ending bankroll small losses and small wins and the large wins will be somewhat increased and the medium size wins somewhat decreased from what is shown below, giving an additional reason to cap your maximum bet at 4 units instead of 6. Column (7) of Exhibit 4G shows that the total bet is doubled 12% of the time. This reflects that doubling occurs approximately 10% of the time and splitting occurs approximately 2% of the time so that 12% of the time the total bet is doubled. This does not reflect extra bets made from DAS and/or re-splitting as mentioned above. Also, as shown in columns (2a) through (2e), pushes are ignored, the simulation showing that a bet is either won or lost. So the day trip is actually 200 hands played with an actual win or loss decision on each of these 200 hands so that pushes are not counted as part of the 200 hands played.



With an initial bankroll of 80 units, the above graph shows that conservative C2-C6 betting system results in more small losses and small wins (ending bankroll 70 to 100 units), less medium size wins (ending bankroll between 100 and 140 units) and more large wins (ending bankroll over 150 units) than does conservative C2-C4 betting system.

To protect profits, during a losing streak, a conservative player will immediately cut back to betting schedule C2 with its maximum bet of 2 units, even if his bankroll is over 60 units and, if he continues to lose, if he is playing two hands at two units, he will cut back to one hand at two units or two hands at one unit each until he starts winning again. Preservation of bankroll and profits are the primary consideration during a losing streak.

Conversely, during a winning streak, a player may want to immediately switch to betting schedule C6, bypassing betting schedules C4 and C5 altogether. As described in an earlier footnote, with betting schedule C6 a maximum bet of 6 units occurs at true counts >= 7 when the bankroll is greater than 100 units and if the bankroll falls below 100 units, or if you lost a couple of large bets in a row, you immediately switch back to betting schedule C3 with its maximum bet of 3 units which occurs at true counts >= 4.

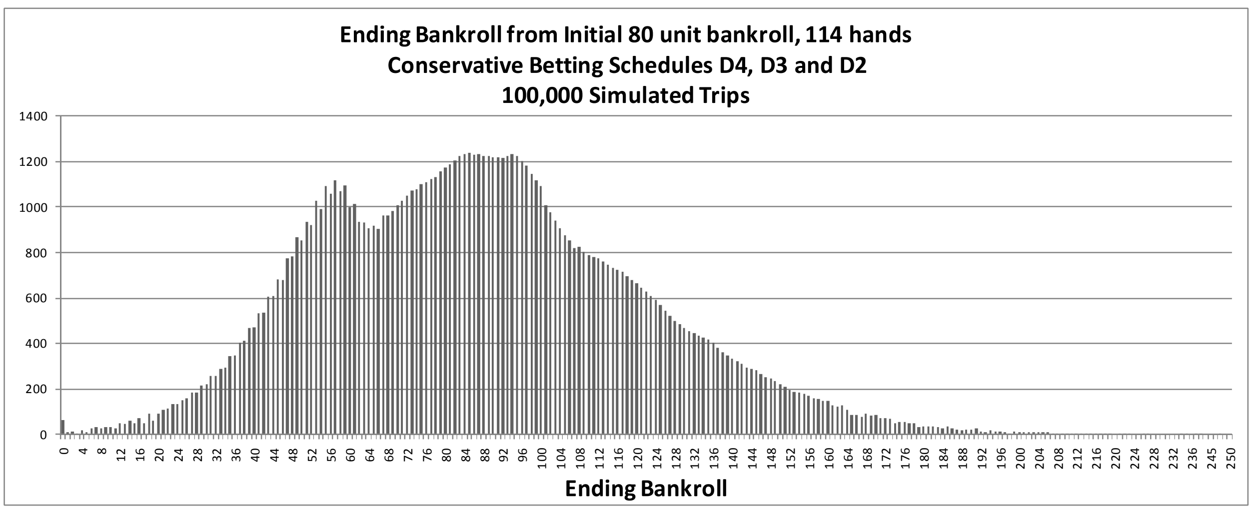
If the table minimum is two units, then the conservative C2-C4 can be modified to enter the game at true counts >= 3 with a two unit bet and no bets are to be made below a true count of 3. These schedules would be necessary if, for example, your 80 unit bankroll was calculated for conservative C2-C4 betting system were your unit bet was $25, but the table minimum was $50. Then use betting schedules D2-D4 shown below, instead of betting schedules C2-C4, and enter game with a $50 bet at true counts of 3 or more and zero at all true counts less than 3. With betting schedule D4, the $50 bet is increased to $75 at true count of 4 and $100 at true counts of 5 or more.

Below is a comparison of betting schedules D2, D3 and D4 with C2, C3 and C4, the only difference being that with the D betting schedules, no bet is made at true counts of 2. For all true counts of 3 or more, the D betting schedules are the same as the C betting schedules.

Six Decks, 4.5 Decks Dealt							
Red 7 True Count >= -1							
Leave Table if Red 7 true count < -1							
		Number of Hands Back Counted			756		
		Enter tc >= 2			Enter tc >= 3		
Red 7 "tc"	tot adv	C2	C3	C4	D2	D3	D4
-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	0	0	0
3	1.21%	2	2	2	2	2	2
4	1.90%	2	3	3	2	3	3
5	2.71%	2	3	4	2	3	4
6	3.59%	2	3	4	2	3	4
7	4.46%	2	3	4	2	3	4
8	5.34%	2	3	4	2	3	4
9	6.21%	2	3	4	2	3	4
10	7.09%	2	3	4	2	3	4
# hands played		200	200	200	114	114	114
Amount Bet		354	426	466	257	329	369
• = Expected Win		6.2	8.2	9.7	5.5	7.6	9.1
% adv = E(win) / Bet		1.7%	1.9%	2.1%	2.1%	2.3%	2.5%
• = Std Dev		27.3	34.4	39.0	25.0	32.6	37.5

CONSERVATIVE D2-D4 suggested Bet, in units				
Day Trip: 200 hands with tc >= 2, 114 hands played at tc >= 3				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = 80 units		B = Current Bankroll		
Red 7		D2	D3	D4
run count	true count[1]	B <= 60	60 < B <= 100	B > 100
12	2.0	0.0	0.0	0.0
13	2.3	0.0	0.0	0.0
14	2.7	0.0	0.0	0.0
15	3.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5
17	3.7	2.0	2.5	2.5
18	4.0	2.0	3.0	3.0
19	4.3	2.0	3.0	3.5
20	4.7	2.0	3.0	3.5
>= 21	>= 5	2.0	3.0	4.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3



	Initial Bank = 80 units					Betting Schedule D4:			Betting Schedule D3:
	Red 7 True Count					(Current Bank) > 100 units			60 units < (Cur Bank) <= 100 units
Bet Sch	2	3	4	>= 5					
D4	0	2	3	4		Betting Schedule D2:			
D3	0	2	3	3		(Current Bank) <= 60 units			
D2	0	2	2	2					
	100,000 day trip simulation:								
	Number of Day Trips ending in bankruptcy				65		Skew	0.372	
	Mean				87.3		Kurtosis *	0.002	
	Standard Deviation				33.0		* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.		

Notice that with betting schedules D2-D4 only 114 of 756 back counted hands are played (true counts >= 3) as compared to 200 of the 756 bank counted hands played with the betting schedules C2-C4 (true counts >= 2). Betting schedules D2-D4 have a greater player's advantage and a smaller standard deviation than the corresponding betting schedules C2-C4. The only disadvantage of betting schedules

D2-D4 is a slightly lower expected win[7]. The lower standard deviation of the D2-D4 betting schedules makes the D2-D4 betting schedules an attractive alternative to the C2-C4 betting schedules. Even if the table minimum is equal to your unit bet so that you may use the C2-C4 betting schedules instead of the D2-D4 betting schedules, you may still consider using betting schedules D2-D4 (entering the game with a two unit bet at true counts of 3 or more) instead of C2-C4 (entering the game with a one unit bet at true counts of 2 or more) and if playing C2-C4 and entering when true count >= 3, you can stay in the game with a one unit bet down to a true count of 2.

Betting Schedule Comparisons Conservative D2-D4 versus Conservative C2-C4

Conservative D2-D4
Initial Bank = 80 units

	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
D4	0	2	3	4	B > 100
D3	0	2	3	3	60 < B <= 100
D2	0	2	2	2	B <= 60

Conservative C2-C4
Initial Bank = 80 units

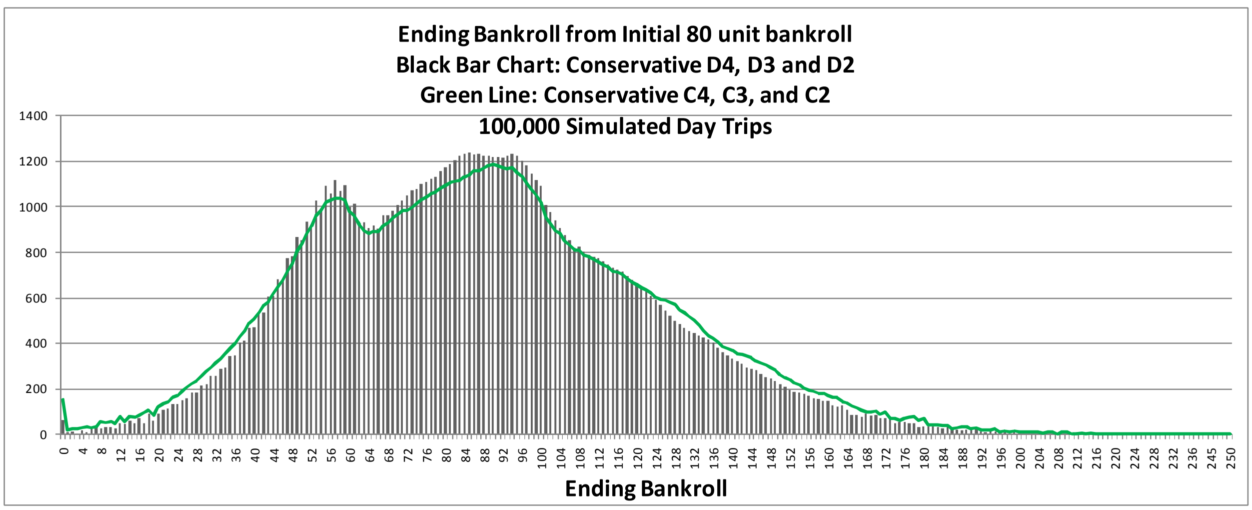
	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
C4	1	2	3	4	B > 100
C3	1	2	3	3	60 < B <= 100
C2	1	2	2	2	B <= 60

	Conservative	
100,000 day trip simulation:	D2-D4	C2-C4
Number of Day Trips ending in bankruptcy	65	154
Mean	87.3	88.1
Standard Deviation	33.0	35.0
Skew	0.372	0.335
Kurtosis *	0.002	-0.056

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative D2-D4 versus Conservative C2-C4

(1) D2-D4 has slightly lower risk of ruin
(2) D2-D4 has slightly lower expected win
(3) D2-D4 has slightly lower standard deviation
(4) D2-D4 approximately equally skewed to the right (long right tail)



Your initial bankroll for betting schedules D2-D4 is calculated similar to betting schedules C2-C4 as described earlier in this paper. For a single hand, your initial bankroll should be 80 units at $25 a unit or $2,000. Assuming betting schedule D3 or D4 (your current bankroll is greater than 60 $25 units or $1,500), at a true count of 4 you will betting one hand at 3 units or $75. Assuming betting schedule D4 (your current bankroll is over 100 $25 units or $2,500) then at true counts >= 5 your bet will be 4 units or $100. With true counts of 4 or more, bet two hands, each hand at ¾th the amount that you would have bet on a single hand.

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[7] By adding $50 tables to the $25 tables for possibly entry when your unit bet is $25 you should be able to back count more than the assumed 756 hands in a day trip and so play more than 114 true count >= 3 hands - more day trip hands played means greater expected day trip win. Also, $50 tables are typically not as crowded as the $25 tables so on the $50 tables there should be open spots to play when the true count equals or exceeds 3.

Betting Schedules C4 and D4 suggested units bet are approximately proportional to the total player advantage (ta) for true counts between 2 and 5.

Total Player Advantage (ta) by Red 7 true count					
Red 7 "tc" (t)	tot adv (ta)	ta(t)/ta(2)	Bet Sch C4	2*(ta(t)/ta(3))	Bet Sch D4
2	0.66%	1.0	1	n/a	n/a
3	1.21%	1.8	2	2.0	2
4	1.90%	2.9	3	3.1	3
5	2.71%	4.1	4	4.5	4
6	3.59%	5.4	4	5.9	4
7	4.46%	6.7	4	7.4	4
8	5.34%	8.1	4	8.8	4
9	6.21%	9.4	4	10.2	4
10	7.09%	10.7	4	11.7	4

Here is what would happen if instead of dropping the two unit $50 bet to zero at true counts of less than three as per betting schedules D2-D4, a new betting schedule was introduced, betting schedules E2-E4, where you still enter the $50 table at true counts of three or more but continue to bet the two unit $50 bet all the way down to a true count of 2.

Betting Schedule Comparisons Conservative E2-E4 versus Conservative D2-D4

Conservative D2-D4
Initial Bank = 80 units

	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
D4	0	2	3	4	B > 100
D3	0	2	3	3	60 < B <= 100
D2	0	2	2	2	B <= 60

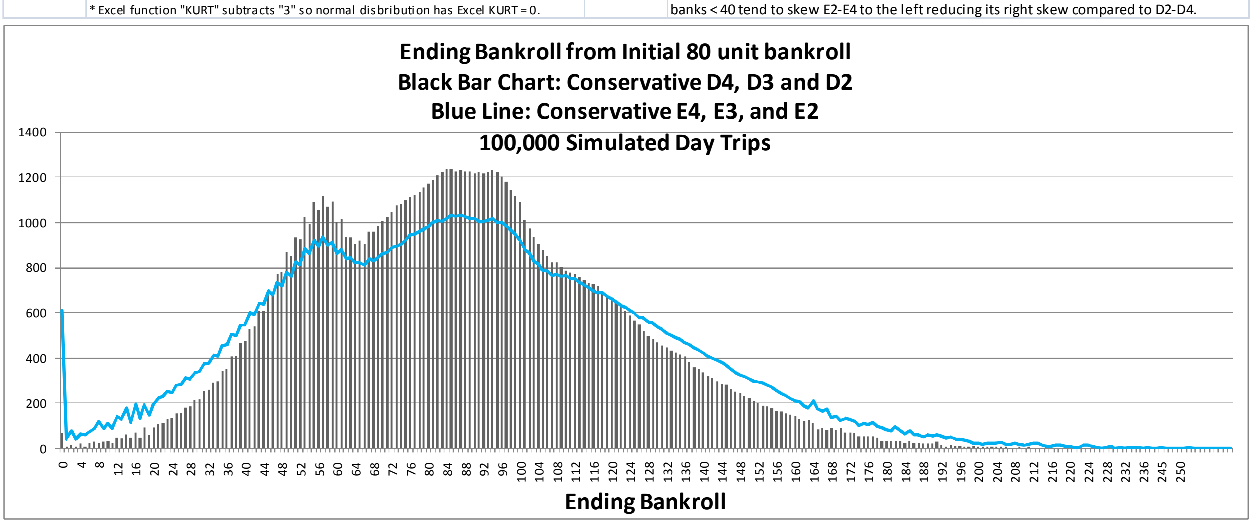
Conservative E2-E4
Initial Bank = 80 units

	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
E4	2	2	3	4	B > 100
E3	2	2	3	3	60 < B <= 100
E2	2	2	2	2	B <= 60

	Conservative	
100,000 day trip simulation:	D2-D4	E2-E4
Number of Day Trips ending in bankruptcy	65	610
Mean	87.3	88.7
Standard Deviation	33.0	39.7
Skew	0.372	0.297
Kurtosis *	0.002	-0.013

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative E2-E4 versus Conservative D2-D4
(1) E2-E4 has higher of risk of ruin
(2) E2-E4 has higher expected win
(3) E2-E4 has higher standard deviation
(4) E2-E4 is more symmetric (less skewed): E2-E4 has less ending bankrolls between 50 and 120 and more ending bankrolls over 120 and less than 40 -- the ending banks < 40 tend to skew E2-E4 to the left reducing its right skew compared to D2-D4.



Below are my final betting schedule recommendations for the $50 table minimum game, either D2-D4 or E2-E4, and the $25 table minimum game, C2-C4, with a starting a day trip initial bankroll of $2,000 which is 80 units of $25 per unit.

For the $25 game, the game is entered with a one unit bet at true count = 2 which is Red 7 = 12 for the six deck game. Notice that with the $50 minimum game that you enter with a two unit bet of $50 at a true count of 3 you do not have this choice to drop your bet to $25 if the true count falls below 3 – in the $50 game you either have to continue to bet $50 at a true count of 2 (betting schedules E2-E4) or sit out these hands and bet zero (betting schedules D2-D4). If your bankroll is below $1,500 (60 units) then play only one hand. If your bankroll is between $1,500 (60 units) and $2,500 (100 units), and the true count is greater than or equal to 4, i.e. Red 7 >= 18 for the six deck three deck dealt game, then if two spots are open, bet two hands of $50 or $55 each instead of one hand at $75 (¾th's of $75 ≈ $55). If your bankroll is over $2,500 (100 units) and the true count is greater than or equal to 4, then instead of betting $75 or $100 on one hand, bet two hands of $50 or $75 each as shown in the above chart.

$25 Table Minimum				
Day Trip: Table Entry at Red 7 >= 12				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = $2,000		B = Current Bankroll		
Red 7		C2	C3	C4
run count	true count[1]	B <= $1,500	$1,500 < B <= $2,500	B > $2,500
12	2.0	$25	$25	$25
13	2.3	$35	$35	$35
14	2.7	$40	$40	$40
15	3.0	$50	$50	$50
16	3.3	$50	$60	$60
17	3.7	$50	$65	$65
18	4.0	$50	$75[2]	$75[2]
19	4.3	$50	$75[2]	$85[3]
20	4.7	$50	$75[2]	$90[3]
>= 21	>= 5	$50	$75[2]	$100[4]

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

[2] Instead of playing one hand at $75, two hands at $50 or $55 may be played (¾th's of $75 ≈ $55)

[3] Instead of playing one hand at $85 or $90, two hands at $60 or $65 may be played

[4] Instead of playing one hand at $100, two hands at $75 may be played

For the $50 table with a $2,000 that is entered with two unit bet of $50 (each unit being $25) either betting schedule D2-D4 may be used (bet zero below true count of 3) or betting schedules E2-E4 may be used (bet two units at Red 7 true count of 2). The optimal bet would be one unit of $25 at Red 7 true count of two because of the table minimum of $50 which is two $25 units, then the choices are either to bet no units at true count of 2 (betting schedule D2-D4) or two units at Red 7 true count of 2 (betting schedule E2-E4) as shown below.

$50 Table Minimum				
Day Trip: Table Entry at Red 7 >= 15				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = $2,000		B = Current Bankroll		
Red 7		D2	D3	D4
run count	true count[1]	B <= $1,500	$1,500 < B <= $2,500	B > $2,500
12	2.0	$0	$0	$0
13	2.3	$0	$0	$0
14	2.7	$0	$0	$0
15	3.0	$50	$50	$50
16	3.3	$50	$60	$60
17	3.7	$50	$65	$65
18	4.0	$50	$75[2]	$75[2]
19	4.3	$50	$75[2]	$85[3]
20	4.7	$50	$75[2]	$90[3]
>= 21	>= 5	$50	$75[2]	$100[4]

1 tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

2 Instead of playing one hand at $75, two hands at $50 or $55 may be played (¾th's of $75 ≈ $55)

3 Instead of playing one hand at $85 or $90, two hands at $60 or $65 may be played

4 Instead of playing one hand at $100, two hands at $75 may be played

$50 Table Minimum				
Day Trip: Table Entry at Red 7 >= 15				
Six Decks at the Three Deck Dealt Level				
Initial Bankroll = $2,000		B = Current Bankroll		
Red 7		E2	E3	E4
run count	true count[1]	B <= $1,500	$1,500 < B <= $2,500	B > $2,500
12	2.0	$50	$50	$50
13	2.3	$50	$50	$50
14	2.7	$50	$50	$50
15	3.0	$50	$50	$50
16	3.3	$50	$60	$60
17	3.7	$50	$65	$65
18	4.0	$50	$75[2]	$75[2]
19	4.3	$50	$75[2]	$85[3]
20	4.7	$50	$75[2]	$90[3]
>= 21	>= 5	$50	$75[2]	$100[4]

1 tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

2 Instead of playing one hand at $75, two hands at $50 or $55 may be played (¾th's of $75 ≈ $55)

3 Instead of playing one hand at $85 or $90, two hands at $60 or $65 may be played

4 Instead of playing one hand at $100, two hands at $75 may be played

I have presented several betting systems for the reader to choose from. My personal favorite is the conservative C2-C4 betting system, where your initial bankroll is 80 units and you start with betting schedule C3[8] with its maximum bet of 3 units at a true count of 4 or more. If you are winning (your current bankroll is greater than 100 units) switch to betting schedule C4 with its maximum bet of 4 units at a true count of 5 or more. If you are losing (your current bankroll is less than 60 units) switch to betting schedule C2 with its maximum bet of 2 units for all true counts of 3 or more. Winning and losing streaks, as mentioned above, should also be taken into account for possible early switching from the benchmark switching bankrolls of 60 units or less to switch to betting schedule C2 and over 100 units to switch to betting schedule C4. As explained earlier, it is not necessary to be exact as to when you increase or decrease your maximum bet size. The maximum bet should be increased from 2 to 3 to 4 units gradually as your bankroll increases and should be dropped quickly from 4 to 3 to 2 units as your bankroll decreases and if playing two hands in a losing streak, switch to one hand until you start winning and your bankroll recovers.

[8] A conservative version of Schedule C3 would be to bet one unit on one hand at true counts of 2, two units on one hand at true counts of 3 and instead of three units on one hand at true counts of 4 or more, bet two units on each of two hands at true counts of 4 or more. Two hands of two units each is risk equivalent to one hand at (4/3)*(2 units) ≈ 2.7 units – so two hands of two units each is less risky than one hand of three units. The total initial amount bet on two hands of two units each is four units so the expected win betting two hands of two units each is (4/3)rds the expected win betting one hand of three units, i.e., the expected win of two hands at two units each is an increase of approximately 33% over the expected win of one hand at three units. So playing two hands at two units each at true counts of 4 or more is less risky and has a greater expected win than playing one hand at three units at true counts of 4 or more.

Appendix
Shifted Red 7* count

* if src = Shifted Red 7 running count, n = number of decks, and rc = Red 7 count
src = rc - 2*n

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)
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

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 = src + 2, max bet = 6
1 < dp < 1.5: (floating advantage)
units bet = src + 3, 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

Exhibit 1

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 if src >= (Idx - 2) * dr
Idx may be approximated by six or eight deck Hi-Low index.

Two Deck play all game:

src = rc - 4, tc = 2 + (src/dr)
0 < dp < 1:   units bet = src + 2, max bet = 6
1 < dp < 1.5:   units bet = src + 3, max bet = 6
Playing Strategy Change if src >= (Idx - 2) * dr
Idx may be approximated by two deck Hi-Low index.

7u compared to Red 7

	Infinite Deck Correlation Coefficients (CC)			Weights
Situation	Red 7	7u	7u / Red 7	(Exhibit 2B)
Betting, S17, DAS, no LS	96.8%	98.0%	1.012	n/a
Betting, H17, DAS, no LS	97.0%	98.2%	1.012	n/a
Insurance	77.1%	78.0%	1.012	28.5%
h8 v 5	90.5%	91.6%	1.012	1.5%
h8 v 6	83.1%	84.1%	1.012	1.0%
h9 v 2	83.9%	84.9%	1.012	1.5%
h9 v 7	84.4%	85.4%	1.012	2.1%
h10 v T	86.0%	87.1%	1.012	9.8%
h10 v A	95.4%	96.5%	1.012	1.8%
h11 v A	83.2%	84.2%	1.012	1.4%
h12 v 2	66.8%	67.6%	1.012	2.6%
h12 v 3	73.4%	74.2%	1.012	2.1%
h15 v T	77.1%	78.0%	1.012	16.1%
h16 v T	57.1%	57.7%	1.012	9.8%
h16 v 9	45.4%	46.0%	1.012	2.7%
h16 v 8	41.4%	41.9%	1.012	1.9%
h16 v 7	31.5%	31.9%	1.012	1.9%
A2 v 4	64.3%	65.1%	1.012	0.8%
A3 v 4	67.1%	67.9%	1.012	0.7%
A4 v 3	36.1%	36.6%	1.012	0.4%
A5 v 3	33.1%	33.5%	1.012	0.6%
A6 v 2	32.6%	33.0%	1.012	0.5%
A7 v 2	41.4%	41.9%	1.012	0.5%
soft 18 v A	48.6%	49.2%	1.012	0.3%
A8 v 6	80.4%	81.3%	1.012	0.5%
A8 v 5	85.2%	86.2%	1.012	0.5%
A8 v 4	77.3%	78.2%	1.012	0.7%
A8 v 3	73.4%	74.3%	1.012	0.4%
A9 v 6	90.6%	91.7%	1.012	0.5%
A9 v 5	94.7%	95.9%	1.012	0.6%
4.4 v 4 DAS	79.6%	80.5%	1.012	0.3%
9.9 v 7 DAS	66.4%	67.2%	1.012	0.3%
9.9 v A DAS	78.4%	79.3%	1.012	0.3%
TT v 6	89.8%	90.9%	1.012	4.5%
TT v 5	93.9%	95.0%	1.012	2.9%
Play Only	74.3%	75.2%	1.012	100.0%

Notes:

7 unbalanced, same as Red 7 except instead of counting the Red 7's as +1 and Black 7's as zero, as the Red 7 does, with 7u, all 7's counted as +0.5. 7 unbalanced has an unbalance of +2 per deck, just like the Red 7, so the pivot point of the 7u is a true count of 2 (Exhibit 2C, row "unbalance per deck"). For each situation, the infinite deck CC(7u) = 1.012 * CC(Red 7) so the weighted average correlation coefficient of 7u (75.2%) is also 1.012 times the weighted average Red 7 correlation coefficient (74.3%). Referring to Exhibit 2C, rows CORREL(Y,X), STDEVP(X), AACpTCp and "Index, inf deck" under the corresponding column "X2/X1" it can be seen that the infinite deck 7u CC increases 1.2%, SD decreases 1.2%, AACpTCp increases 2.4% and index decreases 2.4% over the Red 7 CC, SD, AACpTCp and index. Since indices are rounded to the nearest integer the Red 7 playing strategy indices and betting strategy can be used directly with the 7u without any modifications.

Selection of Correlation Coefficient Relative Weights

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		= (2) - 1.0	= (3) * 2.0 if dbl or split		= (2) Rounded Down	4.5 of 6 decks dealt	= (5) * (7)	= (4) * (8)	= (9) / Tot (9)
Situation	Infinite Deck Hi-Low Playing Strategy Index	Initial Units Bet at Index 1 to 4 units units bet = (tc - 1)	Units Bet double & splits splits at	Hand Freq per 100,000 Hands (A)	Infinite Deck Hi-Low True Count: Index >= 2: counting	% of hands at Hi-Low true count = "t"	Hand Frequency at Hi-Low true count = "t"	Total Units Bet at Index	Judgmental Relative Weights [1]
Insurance	3.33	2.33	2.33	7,692	3	4.0%	309	720	28.5%
h8 v 5	3.56	2.56	5.12	179	3	4.0%	7	37	1.5%
h8 v 6, S17	1.61	1.00	2.00	179	2	7.0%	13	25	1.0%
h9 v 2	0.89	1.00	2.00	271	2	7.0%	19	38	1.5%
h9 v 7	3.48	2.48	4.97	271	3	4.0%	11	54	2.1%
h10 v T	3.62	2.62	5.23	1,181	3	4.0%	47	248	9.8%
h10 v A, S17	3.61	2.61	5.22	215	3	4.0%	9	45	1.8%
h11 v A, S17	1.42	1.00	2.00	249	2	7.0%	18	35	1.4%
h12 v 2	3.17	2.17	2.17	750	3	4.0%	30	65	2.6%
h12 v 3	1.36	1.00	1.00	750	2	7.0%	53	53	2.1%
h15 v T	3.87	2.87	2.87	3,530	3	4.0%	142	407	16.1%
h16 v T	0.08	1.00	1.00	3,530	2	7.0%	249	249	9.8%
h16 v 9	4.23	3.23	3.23	960	4	2.2%	21	69	2.7%
h16 v 8	6.02	4.00	4.00	960	5	1.3%	12	49	1.9%
h16 v 7	7.57	4.00	4.00	960	5	1.3%	12	49	1.9%
A2 v 4	3.81	2.81	5.61	92	3	4.0%	4	21	0.8%
A3 v 4	2.45	1.45	2.91	92	2	7.0%	6	19	0.7%
A4 v 3	10.43	4.00	8.00	92	5	1.3%	1	9	0.4%
A5 v 3	4.97	3.97	7.94	92	4	2.2%	2	16	0.6%
A6 v 2	1.50	1.00	2.00	92	2	7.0%	6	13	0.5%
A7 v 2	0.23	1.00	2.00	92	2	7.0%	6	13	0.5%
s18 v A: S17, hit/std	1.36	1.00	1.00	99	2	7.0%	7	7	0.3%
A8 v 6, S17	0.81	1.00	2.00	92	2	7.0%	6	13	0.5%
A8 v 5	1.48	1.00	2.00	92	2	7.0%	6	13	0.5%
A8 v 4	3.37	2.37	4.73	92	3	4.0%	4	17	0.7%
A8 v 3	5.38	4.00	8.00	92	5	1.3%	1	9	0.4%
A9 v 6, S17	4.27	3.27	6.53	92	4	2.2%	2	13	0.5%
A9 v 5	4.79	3.79	7.59	92	4	2.2%	2	15	0.6%
4.4 v 4 DAS	3.17	2.17	4.34	38	3	4.0%	2	7	0.3%
9.9 v 7 DAS	3.29	2.29	4.57	43	3	4.0%	2	8	0.3%
9.9 v A DAS, S17	2.78	1.78	3.56	29	2	7.0%	2	7	0.3%
TT v 6, S17	4.50	3.50	7.00	727	4	2.2%	16	113	4.5%
TT v 5	5.09	4.00	8.00	727	5	1.3%	9	74	2.9%
Total	n/a	n/a	n/a	24,444	n/a	n/a	1,037	2,530	100.0%

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 to 10	13,978,480	n/a	5.7%
(>=5) - Tot 5 to 10	616		0.0%

BJ Attack, 3rd Edition, Table 6.12

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%

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

[1] Weight applied to correlation coefficient for a given situation with Index = Idx is proportional to amount bet near the index (since playing strategy accuracy has greatest impact near the index):

(frequency per 100,000 for the given situation) * (proportion of hands where true count, tc, is near the index) * (number of units bet at tc near index)

where (proportion of hands where true count, tc, is near the index) = (proportion of hands where (Idx - (1/2) <= tc <= Idx + (1/2)))

7u compared to Red 7
Infinite Deck Statistics

	Betting, S17, DAS, no LS				Betting, H17, DAS, no LS				Insurance			
	Y = Effect	X1	X2	X2 / X1	Y = Effect	X1	X2	X2 / X1	Y = Effect	X1	X2	X2 / X1
Card	of Removal	Red 7	7u	7u / Red 7	of Removal	Red 7	7u	7u / Red 7	of Removal	Red 7	7u	7u / Red 7
Red 2	0.3809%	1	1	n/a	0.3931%	1	1	n/a	4/221	1	1	n/a
Black 2	0.3809%	1	1	n/a	0.3931%	1	1	n/a	4/221	1	1	n/a
Red 3	0.4339%	1	1	n/a	0.4584%	1	1	n/a	4/221	1	1	n/a
Black 3	0.4339%	1	1	n/a	0.4584%	1	1	n/a	4/221	1	1	n/a
Red 4	0.5680%	1	1	n/a	0.6053%	1	1	n/a	4/221	1	1	n/a
Black 4	0.5680%	1	1	n/a	0.6053%	1	1	n/a	4/221	1	1	n/a
Red 5	0.7274%	1	1	n/a	0.7319%	1	1	n/a	4/221	1	1	n/a
Black 5	0.7274%	1	1	n/a	0.7319%	1	1	n/a	4/221	1	1	n/a
Red 6	0.4118%	1	1	n/a	0.4439%	1	1	n/a	4/221	1	1	n/a
Black 6	0.4118%	1	1	n/a	0.4439%	1	1	n/a	4/221	1	1	n/a
Red 7	0.2823%	1	0.5	n/a	0.2785%	1	0.5	n/a	4/221	1	0.5	n/a
Black 7	0.2823%	0	0.5	n/a	0.2785%	0	0.5	n/a	4/221	0	0.5	n/a
Red 8	-0.0033%	0	0	n/a	0.0061%	0	0	n/a	4/221	0	0	n/a
Black 8	-0.0033%	0	0	n/a	0.0061%	0	0	n/a	4/221	0	0	n/a
Red 9	-0.1731%	0	0	n/a	-0.1949%	0	0	n/a	4/221	0	0	n/a
Black 9	-0.1731%	0	0	n/a	-0.1949%	0	0	n/a	4/221	0	0	n/a
Red 10	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Black 10	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Red J	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Black J	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Red Q	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Black Q	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Red K	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Black K	-0.5121%	-1	-1	n/a	-0.5512%	-1	-1	n/a	- 9/221	-1	-1	n/a
Red A	-0.5794%	-1	-1	n/a	-0.5173%	-1	-1	n/a	4/221	-1	-1	n/a
Black A	-0.5794%	-1	-1	n/a	-0.5173%	-1	-1	n/a	4/221	-1	-1	n/a
Total (a)	0.0000%	1.0000	1.0000	n/a	0.0000%	1.0000	1.0000	n/a	0.0000%	1.0000	1.0000	n/a
μ = mean	0.0000%	0.0385	0.0385	n/a	0.0000%	0.0385	0.0385	n/a	0.0000%	0.0385	0.0385	n/a
unbalance per deck = 52*μ		2.0000	2.0000	n/a		2.0000	2.0000	n/a		2.0000	2.0000	n/a
STDEVP(X)		0.8979	0.8871	0.9880		0.8979	0.8871	0.9880		0.8979	0.8871	0.9880
CORREL(Y,X)		96.83%	98.00%	**1.0121**		96.98%	98.15%	**1.0121**		77.10%	78.04%	**1.0121**
CC / SD		1.0784	1.1047	1.0244		1.0800	1.1064	1.0244		0.8587	0.8797	1.0244
SLOPE(Y,X)		0.505%	0.517%	1.0244		0.524%	0.537%	1.0244		2.331%	2.388%	1.0244
AACpTCp = SLOPE(Y,X) * (51/52)		0.495%	0.507%	1.0244		0.514%	0.527%	1.0244		2.287%	2.342%	1.0244
FDHA, infinite deck		0.5180%	0.5180%	n/a		0.7350%	0.7350%	n/a		7.6923%	7.6923%	n/a
SD / CC		0.9273	0.9052	0.9761		0.9259	0.9038	0.9761		1.1645	1.1368	0.9761
Index, inf. dk = FDHA / AACpTCp		1.05	1.02	0.9761		1.43	1.40	0.9761		3.36	3.28	0.9761

Notes:

* EoR from Blackjack Attack, 3rd edition.

Exhibit K3, *Truing the Red 7 count*: Infinite Deck AACpTCp = k1*(CC/SD) and Infinite Deck Idx = k2*(SD/CC) where, for any particular strategy variation, k1 and k2 are positive constants

SD(7u) = 0.9880*SD(Red 7) and for each strategic situation Infinite Deck AACpTCp(7u) = 1.0244*AACpTCp(Red 7) and Infinite Deck Idx(7u) = 0.9761*Idx(Red 7)

Infinite Deck AACpTCp(7u) / AACpTCp(Red 7) = ((CC/SD):7u) / ((CC/SD):Red 7) = 1.0244 Infinite Deck Idx(7u) / Idx(Red 7) = ((SD/CC):7u) / ((SD/CC):Red 7) = 0.9761

Another way to confirm this reduction of 2.4% in the Red 7 index to give the Seven unbalanced index is to use the relationship Idx = k1*(SD/CC) with SD and CC being the ratios of the 7u to the Red 7 count. So SD(7u) / SD(Red 7) = 0.8871 / 0.8979 = 0.9880 and using S17 betting, CC(7u) / CC(Red 7) = 98.00% / 96.83% = 1.012. So when switching from the Red 7 to the 7u count, the Red 7 SD decreases by 1.2% and the Red 7 correlation coefficient is increased by 1.2%. Idx = k*(SD/CC) means that is the SD decreases the Idx decreases and if the CC increases the index decreases. In this case the SD decreases and the CC increases so both work in the same direction to decrease the 7u index. The calculation for the 7u index as compared to the Red 7 index, using Idx = k*(SD/CC) is Idx(7u) = ((0.9880) / (1.0121)) * Idx(Red 7) = 0.976 * Idx(Red 7), so Idx(7u) is 2.4% below the Idx(Red 7).

Generalized True Count

(from Exhibit K8 of *Truing the Red 7* 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 = Average Advantage Change per True Count point
= {(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)

<u>Example:</u>

Count	Red 7
Situation	h10 v T
k (# decks) =	6
Cor Coef	85.96%
AACpTCp	0.971%
FDHA,"k" dks	3.285%
MDHA,"k" dks	3.452%
MT, "k" dks	(0.167)
YI, "k" decks	(0.0064)
Index, Idx	**3.38**

where
MT = modified tag = T / dr
YI = unbalance term = (-1)*(u*dp) / dr
MT + YI = (T - u*dp)/dr
Idx = MDHA / AACpTCp + MT + YI

<u>**Infinite deck case:**</u>
dr = infinity so MDHA = FDHA
and MT = YI = 0 and so
Inf deck Idx = FDHA / AACpTCp

Exhibit 3A

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)

$rc = u*n + (tc - u)*dr = u*n + (tc - u)*(n - dp) = (u - tc)*dp + n*tc$

$\mathbf{rc = (u - tc)*dp + n*tc}$

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 (u = 2), "n" decks:
rc = 2*n + (tc - 2)*dr **src = (tc - 2)*dr where src = (rc - 2*n)**

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

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

Index Calculation Examples

Red 7, S17, DAS, no LS betting, 2 decks

Count	Red 7
Situation	Betting, S17, DAS, no LS
# decks =	2
Cor Coef	96.83%
AACpTCp	0.495%
FDHA,"k" dks	0.182%
MDHA,"k" dks	0.182%
MT, "k" dks	-
YI, "k" decks	-
Index, Idx	**0.37**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	0.495%
Idx =	0.37

# decks =	2
t	pa(t)
0	-0.18%
1	0.31%
2	0.81%
3	1.30%
4	1.80%
5	2.29%
6	2.79%

pa(6) = player's basic strategy betting advantage at tc = 6 is 2.79%.

Red 7, S17, DAS, no LS betting, 6 decks

Count	Red 7
Situation	Betting, S17, DAS, no LS
k (# decks) =	6
Cor Coef	96.83%
AACpTCp	0.495%
FDHA,"k" dks	0.404%
MDHA,"k" dks	0.404%
MT, "k" dks	-
YI, "k" decks	-
Index, Idx	**0.82**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	0.495%
Idx =	0.82

# decks =	6
t	pa(t)
0	-0.40%
1	0.09%
2	0.59%
3	1.08%
4	1.58%
5	2.07%
6	2.57%

pa(6) = player's basic strategy betting advantage at tc = 6 is 2.57%.

Red 7, H17, DAS, no LS betting, 2 decks

Count	Red 7
Situation	Betting, H17, DAS, no LS
k (# decks) =	2
Cor Coef	96.98%
AACpTCp	0.514%
FDHA,"k" dks	0.384%
MDHA,"k" dks	0.384%
MT, "k" dks	-
YI, "k" decks	-
Index, Idx	**0.75**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	0.514%
Idx =	0.75

# decks =	2
t	pa(t)
0	-0.38%
1	0.13%
2	0.64%
3	1.16%
4	1.67%
5	2.19%
6	2.70%

pa(6) = player's basic strategy betting advantage at tc = 6 is 2.70%.
As true count increases, player's advantage of S17 over H17 decreases.
pa(0):S17 - pa(0):H17 = -0.18% - (-0.38%) = 0.20% but pa(6):S17 - pa(6):H17 = 2.79% - 2.70% = 0.09%.

Red 7, H17, DAS, no LS betting, 6 decks

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	-
Index, Idx	**1.20**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	0.514%
Idx =	1.20

# decks =	6
t	pa(t)
0	-0.62%
1	-0.10%
2	0.41%
3	0.93%
4	1.44%
5	1.95%
6	2.47%

pa(6) = player's basic strategy betting advantage at tc = 6 is 2.47%.
As true count increases, player's advantage of S17 over H17 decreases.
pa(0):S17 - pa(0):H17 = -0.40% - (-0.62%) = 0.22% but pa(6):S17 - pa(6):H17 = 2.57% - 2.47% = 0.10%.

Red 7, Insurance, 2 decks

Count	Red 7
Situation	Insurance
k (# decks) =	2
Cor Coef	78.53%
AACpTCp	2.339%
FDHA,"k" dks	7.692%
MDHA,"k" dks	6.796%
MT, "k" dks	(0.505)
YI, "k" decks	(0.0194)
Index, Idx	**2.38**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	2.339%
Idx =	2.38

# decks =	2
t	pa(t)
0	-5.57%
1	-3.23%
2	-0.89%
3	1.45%
4	3.79%
5	6.13%
6	8.46%

pa(3) = player's basic betting advantage at tc = 3 is 1.45%.

Red 7, Insurance, 6 decks

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)
Index, Idx	**3.04**

FDHA = full deck house advantage
MDHA = modified deck house adv.
pa(t) = player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	2.304%
Idx =	3.04

# decks =	6
t	pa(t)
0	-7.00%
1	-4.69%
2	-2.39%
3	-0.08%
4	2.22%
5	4.52%
6	6.83%

pa(3) = player's basic betting advantage at tc = 3 is -0.08%.

Index Calculation Examples

Red 7, h12 v 2 hit/stand decision, 2 decks

Count	Red 7
Situation	h12 v 2
k (# decks) =	2
Cor Coef	67.07%
AACpTCp	1.284%
FDHA,"k" dks	4.212%
MDHA,"k" dks	4.154%
MT, "k" dks	0.505
YI, "k" decks	(0.0194)
Index, Idx	**3.72**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	1.284%
Idx =	3.72

# decks =	2
t	pa(t)
0	-4.78%
1	-3.49%
2	-2.21%
3	-0.93%
4	0.36%
5	1.64%
6	2.92%

pa(4) = 0.36% means that standing is better than hitting by 0.36% when tc = 4.

Red 7, h12 v 2 hit/stand decision, 6 decks

Count	Red 7
Situation	h12 v 2
k (# decks) =	6
Cor Coef	66.86%
AACpTCp	1.275%
FDHA,"k" dks	4.030%
MDHA,"k" dks	4.010%
MT, "k" dks	0.167
YI, "k" decks	(0.0064)
Index, Idx	**3.31**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	1.275%
Idx =	3.31

# decks =	6
t	pa(t)
0	-4.22%
1	-2.94%
2	-1.67%
3	-0.39%
4	0.88%
5	2.16%
6	3.43%

pa(4) = 0.88% means that standing is better than hitting by 0.88% when tc = 4.

Red 7, h15 v T hit/stand decision, 2 decks

Count	Red 7
Situation	h15 v T
k (# decks) =	2
Cor Coef	76.78%
AACpTCp	0.908%
FDHA,"k" dks	3.355%
MDHA,"k" dks	3.949%
MT, "k" dks	(0.505)
YI, "k" decks	(0.0194)
Index, Idx	**3.82**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	0.908%
Idx =	3.82

# decks =	2
t	pa(t)
0	-3.47%
1	-2.56%
2	-1.66%
3	-0.75%
4	0.16%
5	1.07%
6	1.98%

pa(4) = 0.16% means that standing is better than hitting by 0.36% when tc = 4.

Red 7, h15 v T hit/stand decision, 6 decks

Count	Red 7
Situation	h15 v T
k (# decks) =	6
Cor Coef	76.97%
AACpTCp	0.910%
FDHA,"k" dks	3.516%
MDHA,"k" dks	3.712%
MT, "k" dks	(0.167)
YI, "k" decks	(0.0064)
Index, Idx	**3.91**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	0.910%
Idx =	3.91

# decks =	6
t	pa(t)
0	-3.55%
1	-2.64%
2	-1.73%
3	-0.82%
4	0.09%
5	1.00%
6	1.91%

pa(4) = 0.09% means that standing is better than hitting by 0.88% when tc = 4.

Red 7, h16 v T hit/stand decision, 2 decks

Count	Red 7
Situation	h16 v T
k (# decks) =	2
Cor Coef	56.62%
AACpTCp	0.751%
FDHA,"k" dks	-0.192%
MDHA,"k" dks	0.361%
MT, "k" dks	(0.505)
YI, "k" decks	(0.0194)
Index, Idx	**-0.04**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	0.751%
Idx =	-0.04

# decks =	2
t	pa(t)
0	0.03%
1	0.78%
2	1.53%
3	2.28%
4	3.04%
5	3.79%
6	4.54%

pa(0) = 0.03% means that standing is better than hitting by 0.03% when tc = 0.

Red 7, h16 v T hit/stand decision, 6 decks

Count	Red 7
Situation	h16 v T
k (# decks) =	6
Cor Coef	56.91%
AACpTCp	0.753%
FDHA,"k" dks	-0.023%
MDHA,"k" dks	0.160%
MT, "k" dks	(0.167)
YI, "k" decks	(0.0064)
Index, Idx	**0.04**

pa(t) =
difference standing vs hitting
player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	0.753%
Idx =	0.04

# decks =	6
t	pa(t)
0	-0.03%
1	0.72%
2	1.48%
3	2.23%
4	2.98%
5	3.74%
6	4.49%

pa(0) = -0.03% means that hitting is better than standing by 0.03% when tc = 0.

Index Calculation Examples

Red 7, double h10 v T, 2 decks

Count	Red 7	pa(t) =	# decks =	2
Situation	h10 v T	**difference doubling vs hitting**		
k (# decks) =	2	player's advantage	t	pa(t)
Cor Coef	85.87%	at true count "t"	0	-3.07%
AACpTCp	0.971%		1	-2.10%
FDHA,"k" dks	3.073%	***pa(t) = AACpTCp * (t - Idx)***	2	-1.12%
MDHA,"k" dks	3.576%	# decks = 2	3	-0.15%
MT, "k" dks	(0.505)	AACpTCp = 0.971%	4	0.82%
Yl, "k" decks	(0.0194)	Idx = 3.16	5	1.79%
Index, Idx	**3.16**		6	2.76%

pa(4) = 0.82% means that doubling is better than hitting by 0.82% when tc = 4.

Risk Adjusted Index = 5 or 6

Red 7, double h10 v T, 6 decks

Count	Red 7	pa(t) =	# decks =	6
Situation	h10 v T	**difference doubling vs hitting**		
k (# decks) =	6	player's advantage	t	pa(t)
Cor Coef	85.96%	at true count "t"	0	-3.28%
AACpTCp	0.971%		1	-2.31%
FDHA,"k" dks	3.285%	***pa(t) = AACpTCp * (t - Idx)***	2	-1.34%
MDHA,"k" dks	3.452%	# decks = 6	3	-0.37%
MT, "k" dks	(0.167)	AACpTCp = 0.971%	4	0.60%
Yl, "k" decks	(0.0064)	Idx = 3.38	5	1.57%
Index, Idx	**3.38**		6	2.54%

pa(4) = 0.60% means that doubling is better than hitting by 0.60% when tc = 4.

Risk Adjusted Index = 5 or 6

<u>Using AACpTCp and Idx, which determine pa(t), to estimate risk adjusted index.</u>

pa(t) = AACpTCp*(t - Idx) where pa(t) = change in player's advantage (ex. from doubling vs. standing) at true count "t", t = true count, AACpTCp = Average Advantage Change per True Count point and Idx = Index.
If AACpTCp is small, t >= 4 (so large bet out) and "t" is close to index, i.e. (t - Idx) is small, then pa(t) is small. If decision is to double or split, with a large bet out and minimal "pa", this could lead to over betting bankroll.
For example, doubling h10 v T, six deck AACpTCp = 0.97% and six deck Idx = 3.38. At tc = 4, then pa(4) = 0.97 * (4 - 3.38) = 0.60%. At tc = 4 a large bet is out so doubling a large bet with only a 0.60% advantage increase could lead to over betting bankroll. Thus, the risk adjusted index should be increased by one or two true count points. In h10 v T, index should be increased to 5 or 6. pa(5) = 1.57% and pa(6) = 2.54%. These larger increases in player's advantage associated with the larger true counts would justify the larger bet..

Red 7, double A5 v 3, 2 decks

Count	Red 7	pa(t) =	# decks =	2
Situation	A5 v 3	**difference doubling vs hitting**		
k (# decks) =	2	player's advantage	t	pa(t)
Cor Coef	36.10%	at true count "t"	0	-1.84%
AACpTCp	0.436%		1	-1.41%
FDHA,"k" dks	1.787%	***pa(t) = AACpTCp * (t - Idx)***	2	-0.97%
MDHA,"k" dks	1.644%	# decks = 2	3	-0.54%
MT, "k" dks	0.515	AACpTCp = 0.436%	4	-0.10%
Yl, "k" decks	(0.0594)	Idx = 4.23	5	0.34%
Index, Idx	**4.23**		6	0.77%

pa(5) = 0.34% means that doubling is better than hitting by 0.34% when tc = 5.

Risk Adjusted Index = 7 or 8

Red 7, double A5 v 3, 6 decks

Count	Red 7	pa(t) =	# decks =	6
Situation	A5 v 3	**difference doubling vs hitting**		
k (# decks) =	6	player's advantage	t	pa(t)
Cor Coef	34.08%	at true count "t"	0	-1.69%
AACpTCp	0.409%		1	-1.29%
FDHA,"k" dks	1.681%	***pa(t) = AACpTCp * (t - Idx)***	2	-0.88%
MDHA,"k" dks	1.634%	# decks = 6	3	-0.47%
MT, "k" dks	0.168	AACpTCp = 0.409%	4	-0.06%
Yl, "k" decks	(0.0194)	Idx = 4.15	5	0.35%
Index, Idx	**4.15**		6	0.76%

pa(5) = 0.35% means that doubling is better than hitting by 0.35 when tc = 5.

Risk Adjusted Index = 7 or 8

Index Calculation Examples

Red 7, split 8,8 v T DAS, 2 decks

Count	Red 7
Situation	8,8 v T DAS: split-std
k (# decks) =	2
Cor Coef	-47.44%
AACpTCp	-0.796%
FDHA,"k" dks	-6.256%
MDHA,"k" dks	-6.567%
MT, "k" dks	(0.515)
YI, "k" decks	(0.0594)
Index, Idx	**7.67**

pa(t) =
difference splitting vs standing
player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	-0.796%
Idx =	7.67

# decks =	2
t	pa(t)
0	6.11%
1	5.31%
2	4.52%
3	3.72%
4	2.92%
5	2.13%
6	1.33%
7	0.53%
8	-0.26%

Note: CC and AACpTCp are both negative. This means that as the true count increases, splitting becomes less advantageous than standing.
Expected value index used is "7B": i.e. split if tc:(Red 7) is less than (Below) 7.
Risk adjusted index is "6B": i.e. split if tc:(Red 7) is less than (Below) 6.

Red 7, split 8,8 v T DAS, 6 decks

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)
Index, Idx	**7.51**

pa(t) =
difference splitting vs standing
player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	-0.801%
Idx =	7.51

# decks =	6
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%

Note: CC and AACpTCp are both negative. This means that as the true count increases, splitting becomes less advantageous than standing.
Expected value index used is "7B": i.e. split if tc:(Red 7) is less than (Below) 7.
Risk adjusted index is "6B": i.e. split if tc:(Red 7) is less than (Below) 6.

Exhibit K3 of the Truing the Red 7 paper, *Relationships between AACpTCp, Indices, Corr. Coef, and Std Dev* , shows that for the infinite deck case, AACpTCp = k*(CC/SD) where k = a positive constant and SD is the standard deviation. Since SD must be positive and "k" is positive then AACpTCp and CC must have the same sign. So if the Correlation Coefficient is positive, then the AACpTCp must be positive and likewise if the Correlation Coefficient is negative, then AACpTCp must be negative.

Red 7, split 8,8 v T NDAS, 2 decks

Count	Red 7
Situation	8,8 v T NDAS: split-std
k (# decks) =	2
Cor Coef	-51.09%
AACpTCp	-0.950%
FDHA,"k" dks	-5.115%
MDHA,"k" dks	-5.476%
MT, "k" dks	(0.515)
YI, "k" decks	(0.0594)
Index, Idx	**5.19**

pa(t) =
difference splitting vs standing
player's advantage
at true count "t"

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

# decks =	2
AACpTCp =	-0.950%
Idx =	5.19

# decks =	2
t	pa(t)
0	4.93%
1	3.98%
2	3.03%
3	2.08%
4	1.13%
5	0.18%
6	-0.77%
7	-1.72%
8	-2.67%

Note: CC and AACpTCp are both negative. This means that as the true count increases, splitting becomes less advantageous than standing.
Expected value index used is "5B": i.e. split if tc:(Red 7) is less than (Below) 5.
Risk adjusted index is "4B": i.e. split if tc:(Red 7) is less than (Below) 4.

Red 7, split 8,8 v T NDAS, 6 decks

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)
Index, Idx	**5.12**

pa(t) =
difference splitting vs standing
player's advantage
at true count "t"

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

# decks =	6
AACpTCp =	-0.956%
Idx =	5.12

# decks =	6
t	pa(t)
0	4.90%
1	3.94%
2	2.99%
3	2.03%
4	1.07%
5	0.12%
6	-0.84%
7	-1.80%
8	-2.75%

Note: CC and AACpTCp are both negative. This means that as the true count increases, splitting becomes less advantageous than standing.
Expected value index used is "5B": i.e. split if tc:(Red 7) is less than (Below) 5.
Risk adjusted index is "4B": i.e. split if tc:(Red 7) is less than (Below) 4.

Examples of using Table of Critical Running Counts and Shifted Red 7

Using Table of critical running counts
crc(n,tc,dp) = critical running count for "n" decks, true count row "tc" and decks played column "dp". (See Exhibit 3D for "crc" quick calculation tips)
crc(n,tc,dp) = 2*n + (tc - 2)*dr
Strategy change if rc >= crc

Using Shifted Red 7 running count, src
src = Red 7 - 2*n, n = number of decks
scrc = shifted critical running count = (Idx - 2)*dr, Idx = Red 7 index which is approximated by Hi-Low index
Strategy change if src >= scrc

Note: All shifted running counts and shifted critical running counts are the un-shifted counts decreased by twice the number of decks.
src = rc - 2*n, scrc = crc - 2*n. Also the number of running counts points above (or below) the critical running count is the same using either shifted or un-shifted Red 7 count, i.e. (rc - crc) = # running count points above critical running count = (src - scrc).

2 deck game, shifted Red 7 or shifted Seven unbalanced
For the two deck game, no table of critical running counts has been constructed.
Instead of the Red 7 count, the shifted Red 7 count, src, or the shifted Seven unbalanced count, s7u, is kept with the count starting at -4.

Insurance, shoe	Expected Value Index	Under Insurance Rule
Red 7	Index:(Red 7) = 3	2.8 < tc:(Red 7) < 3

Example
8 decks, 3 decks dealt, Red 7 = 24
src = Red 7 - 2*n = 24 - 2*(8) = 24 - 16 = 8

Calculations:	Calculations using shifted Red 7:
crc(n=8, tc=3, dp=3) = 21	scrc = (Idx - 2)*dr = (3 - 2)*5 = 5
(rc = 24) >= (crc = 21) so insure	(src = 8) >= (scrc = 5) so insure

Notes:
(1) rc = 24 and src = 8 so rc - src = 16
(2) crc = 21 and scrc = 5 so crc - scrc = 16
(3) rc - crc = 24 - 21 = 3 i.e. rc is 3 units above crc so insure with 3 running count points to spare
(4) src - scrc = 8 - 5 = 3 i.e. src is 3 units above scrc so insure with 3 running count points to spare

Examples of using Table of Critical Running Counts and Shifted Red 7

Insurance, 2 deck game, shifted Red 7
shifted Red 7 = src

Expected Value Index
Index:(Red 7) = 2.4

Example
2 decks, 0.75 decks dealt, src = 1
scrc = (Idx - 2)*dr = (2.4 - 2)*dr = 0.4*(1.25) = 0.5
(src = 1) >= (scrc = 0.5) so insure
Or using 2 deck Red 7 insurance rule, insure if src >= 1
Since src = 1, insure

Insurance, 2 deck game, shifted 7u
shifted 7u = s7u

Expected Value Index
Index:(7u) = 2.3

Example
2 decks, 0.75 decks dealt, s7u = 0.5
scrc = (Idx - 2)*dr = (2.3 - 2)*dr = 0.3*(1.25) = 0.375
(s7u = 0.5) >= (scrc = 0.375) so insure
Or using 2 deck 7u insurance rule, insure if s7u >= 0.5
Since s7u = 0.5, insure

Hard 12 v 2, hit/stand, shoe
Red 7

Expected Value Index
Index:(Red 7) = 3 (for shoe)

Example
6 decks, 1 deck dealt, Red 7 = 19
src = Red 7 - 2*n = 19 - 2*(6) = 19 - 12 = 7

Calculations:
crc(n=6, tc=3, dp=1) = 17
(rc = 19) >= (crc = 17) so stand

Calculations using shifted Red 7:
scrc = (Idx - 2)*dr = (3 - 2)*5 = 5
(src = 7) >= (scrc = 5) so stand

Hard 12 v 2, hit/stand, 2 decks
shifted Red 7 = src

Expected Value Index
Index:(Red 7) = 4 (for two decks)

Example
2 decks, 0.75 decks dealt, src = 3
scrc = (Idx - 2)*dr = (4 - 2)*(1.25) = 2.5
(src = 3) >= (scrc = 2.5) so stand

Examples of using Table of Critical Running Counts and Shifted Red 7

Hard 15 v T, hit/stand, shoe
Red 7

Expected Value Index
Index:(Red 7) = 4

Example
8 decks, 4 decks dealt, Red 7 = 27
src = Red 7 - 2*n = 27 - 2*(8) = 27 - 16 = 11

Calculations:
crc(n=8, tc=4, dp=4) = 24
(rc = 27) >= (crc = 24) so stand

Calculations using shifted Red 7:
scrc = (Idx - 2)*dr = (4 - 2)*(4) = 8
(src = 11) >= (scrc = 8) so stand

Hard 15 v T, hit/stand, 2 decks
shifted Red 7 = src

Expected Value Index
Index:(Red 7) = 4

Example
2 decks, 0.50 decks dealt, src = 3
scrc = (Idx - 2)*dr = (4 - 2)*(1.50) = 3
(scr = 3) >= (scrc = 3) so borderline stand

Hard 16 v T, hit/stand, shoe
Red 7

Expected Value Index
Index:(Red 7) = 0

Example
8 decks, 5 decks dealt, Red 7 = 9
src = Red 7 - 2*n = 9 - 2*(8) = 9 - 16 = -7

Calculations:
crc(n=8, tc=0, dp=5) = 2*dp[1] = 2*(5) = 10
(rc = 9) < (crc = 10) so hit

Calculations using shifted Red 7:
scrc = (Idx - 2)*dr = (0 - 2)*3 = -6
(src = -7) < (scrc = -6) so hit

[1] Red 7 = 2*n + (tc - 2)*dr
so at tc = 0, Red 7 = 2*n + (0-2)*dr = 2*(n - dr) = 2*dp

Hard 16 v T, hit/stand, 2 decks
shifted Red 7 = src

Expected Value Index
Index:(Red 7) = 0

Example
2 decks, 1.25 decks dealt, src = -1
scrc = (Idx - 2)*dr = (0 - 2)*(0.75) = -1.5
(scr = -1) >= (scrc = -1.5) so stand

Examples of using Table of Critical Running Counts and Shifted Red 7

Hard 16 v 9, hit/stand, shoe
Red 7

Expected Value Index
Index:(Red 7) = 5

Example
6 decks, 2 decks dealt, Red 7 = 22
src = Red 7 - 2*n = 22 - 2*(6) = 22 - 12 = 10

Calculations:
crc(n=6, tc=5, dp=2) = 24
(rc = 22) < (crc = 24) so hit

Calculations using shifted Red 7:
scrc = (Idx - 2)*dr = (5 - 2)*4 = 12
(src = 10) < (scrc = 12) so hit

Hard 16 v 9, hit/stand, 2 decks
shifted Red 7 = src

Expected Value Index
Index:(Red 7) = 5

Example
2 decks, 0.75 decks dealt, src = 4
scrc = (Idx - 2)*dr = (5 - 2)*(1.25) = 3.75
(scr = 4) >= (scrc = 3.75) so stand

Table of Critical Running Counts Building Patterns

Using row or column table building patterns for quick calculation of critical running counts

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

Building Table, Pattern # 1, Eight Decks

Build Table

true count	*decks played* add	base	add	add
2	0	***16***	0	0
3	1	***20***	-1	-1
4	2	***24***	-2	-2
5	3	***28***	-3	-3

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

true count	*decks played* 5	*4*	3	2
2	16	***16***	16	16
3	21	***20***	19	18
4	n/a	***24***	22	20
5	n/a	***28***	25	22

Building Table, Pattern # 2, Eight Decks

Build Table

true count	*decks played* 5	*4*	3	2
base	***16***	***16***	***16***	***16***
add	5	4	3	2
add	5	4	3	2
add	5	4	3	2

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

true count	*decks played* 5	*4*	3	2
2	***16***	***16***	***16***	***16***
3	21	20	19	18
4	n/a	24	22	20
5	n/a	28	25	22

Table of Critical Running Counts Building Patterns

<u>Using base columns, dp = 3 for six decks and dp = 4 for eight decks, for quick calculations of critical running counts</u>

crc(n,tc,dp) = critical running count for "n" decks, true count row "tc" and decks played column "dp".

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)

Eight Decks

*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	n/a	***24***	20	3
5	n/a	***28***	22	4 (max)

Read down Decks Played Column for betting, across True Count Rows for playing strategy variation.

dp < 3: max bet = 2 units

Examples:

(1) crc(n=8,tc=4,dp=5).

Using eight deck base column of dp = 4, the crc for tc = 2, 3, 4 and 5 are 16, 20, 24, 28 respectively.

For true count row 4, the base column, dp = 4, entry is crc = 24. A true count of 4 is 2 true count points above the pivot point true count of 2 which means each time dp changes by 1, the crc changes by 2. So if the dp is increased from the base column by 1, i.e. dp is increased from 4 to 5, then crc is decreased by 2.

So if dp = 5 then crc of 24 for dp = 4 base column is decreased by 2 giving crc = 22.

(2) crc(n=8,tc=5,dp=6).

Using eight deck base column of dp = 4, the crc for tc = 2, 3, 4 and 5 are 16, 20, 24, 28 respectively.

For true count row 5, the base column, dp = 4, entry is crc = 28. A true count of 5 is 3 true count points above the pivot point true count of 2 which means each time dp changes by 1, the crc changes by 3. So if the dp is increased from the base column by 2, i.e. dp is increased from 4 to 6, then crc is calculated as follows.

For true count row 5, going from dp = 4 to 5, the crc is decreased from 28 to 25 and going from dp = 5 to 6 the crc is further decreased to 22. So crc(n=8,tc=5,dp=6) = 22.

(3) crc(n=8,tc=6,dp=5).

Using eight deck base column of dp = 4, the crc for tc = 2, 3, 4 and 5 are 16, 20, 24, 28 respectively.

Extrapolating base column to tc = 6 gives crc of 32, i.e. tc = 2, 3, 4, 5 and 6 are 16, 20, 24, 28 and 32.

So for true count row 6, the base column, dp = 4, entry is crc = 32. A true count of 6 is 4 true count points above the pivot point true count of 2 which means each time dp changes by 1, the crc changes by 4. So if the dp is increased from the base column by 1, i.e. dp is increased from 4 to 5, then crc is decreased by 4 so crc(tc=6,dp=5) is crc(tc=6,dp=4) decreased by 4, i.e. crc(tc=6,dp=5) = crc(tc=6,dp=4) - 4 = 32 - 4 = 28. Or as an alternative use the base column , dp = 4, and tc = 5 row of 28 and moving across that tc = 5 row from dp = 4 to dp = 5 column gives table entry of 25 and moving up one true count point from 5 to 6 on the dp = 5 column gives table entry of 28. As a final alternative the true count formula can be directly used: tc = 2 + (Red 7 - 2*n) / dr, which can be written as, Red 7 = 2*n + (tc - 2)*dr. Plugging in n = 8, dr = 3 and tc = 6 gives Red 7 = 28.

Table of Critical Running Counts Building Patterns

Notice that for every true count, as decks played increases, the running counts converge toward the pivot point true count of 2 which is twice the number of decks or 12 for the six deck game and 16 for the eight deck game.

Red 7 running count for 6 deck game

rc = 12 + (tc - 2) * dr

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

Red 7 running count for 8 deck game

rc = 16 + (tc - 2) * dr

Eight deck running count	true count	decks played (dp) 1	2	3	4	5	6	7	8
16 - 2*dr = 2*dp	*0*	2	4	6	8	10	12	14	16
16 - dr	*1*	9	10	11	12	13	14	15	16
16	*2*	16	**16**	16	***16***	16	**16**	16	16
16 + dr	*3*	23	**22**	21	***20***	19	**18**	17	16
16 + 2*dr	*4*	30	28	26	***24***	22	**20**	18	16
16 + 3*dr	*5*	37	34	31	***28***	25	**22**	19	16

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
(Modified from Exhibit F1c, Truing the Red 7 count)

		Number of Hands Back Counted				756			
		Betting Schedule, Units Bet							
Red 7 "tc"	tot adv	A	B	C	D	A'	B'	C'	D'
-1	-0.90%	0	0	0	0	0	0	0	0
0	-0.40%	0	0	0	0	0	0	0	0
1	0.09%	0	0	0	0	0	0	0	0
2	0.66%	1	1	1	1	0	0	0	0
3	1.21%	1	1	2	2	1	1	1	1
4	1.90%	1	2	3	3	1	2	2	2
5	2.71%	1	2	4	4	1	2	3	3
6	3.59%	1	2	4	5	1	2	4	4
7	4.46%	1	2	4	6	1	2	4	5
8	5.34%	1	2	4	7	1	2	4	6
9	6.21%	1	2	4	8	1	2	4	7
10	7.09%	1	2	4	9	1	2	4	8
# hands played		200	200	200	200	114	114	114	114
Amount Bet		226	298	466	510	129	201	263	284
μ = Expected Win		3.4	5.5	9.7	11.9	2.8	4.8	7.3	8.5
% adv = E(win) / Bet		1.5%	1.8%	2.1%	2.3%	2.1%	2.4%	2.8%	3.0%
σ = Std Dev		16.6	23.2	39.0	45.6	12.5	20.5	29.2	33.4

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
(Modified from Exhibit F1c, Truing the Red 7 count)

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

Exhibit F1a
Betting, S17, DAS, no LS
AACpTCp = 0.495% Idx = 0.81

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 756

						Betting Schedule A				
(A)	(B)	(C)	(D)	(E)	(F) = (D) + (E)	(G1)	(G2)	(G3)=(G1)*(G2)*k	(G4) = (G3) * (F)	(G5)
Red 7 "tc"	Hand %	Hand Frequency	ba(t)	sg(t)	tpa(t)	Units Bet	# hands played	Amount Bet	Expected Win	= (G2)*(G1)^2
-1	20.8%	157	-0.90%	0.00%	-0.90%	0	-	-	-	-
0	32.0%	242	-0.40%	0.00%	-0.40%	0	-	-	-	-
1	20.7%	156	0.09%	0.00%	0.09%	0	-	-	-	-
2	11.4%	86	0.59%	0.07%	0.66%	1	86	97	0.64	86
3	6.6%	50	1.08%	0.13%	1.21%	1	50	56	0.68	50
4	3.8%	29	1.58%	0.32%	1.90%	1	29	32	0.61	29
5	2.1%	16	2.07%	0.64%	2.71%	1	16	18	0.48	16
6	1.2%	9	2.57%	1.02%	3.59%	1	9	10	0.37	9
7	0.7%	5	3.06%	1.40%	4.46%	1	5	6	0.27	5
8	0.4%	3	3.56%	1.78%	5.34%	1	3	3	0.18	3
9	0.2%	2	4.05%	2.16%	6.21%	1	2	2	0.11	2
10	0.1%	1	4.55%	2.54%	7.09%	1	1	1	0.06	1
Total	100.0%	756				n/a	200	226	**3.4**	200

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 = 3.4 / 226 = **1.51%** SQRT:
Standard Deviation = SQRT(Tot (G5)) * 1.17 **16.6** 14
Standard Deviation / Expected Win **4.9**

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
(Modified from Exhibit F1c, Truing the Red 7 count)

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	-	-	-	-	0	-	-	-	-
0	0	-	-	-	-	0	-	-	-	-
1	0	-	-	-	-	0	-	-	-	-
2	1	86	97	0.64	86	1	86	97	0.64	86
3	1	50	56	0.68	50	2	50	112	1.36	200
4	2	29	65	1.23	115	3	29	97	1.84	259
5	2	16	36	0.97	64	4	16	72	1.94	254
6	2	9	20	0.73	36	4	9	41	1.47	145
7	2	5	12	0.53	21	4	5	24	1.06	85
8	2	3	7	0.36	12	4	3	14	0.73	48
9	2	2	3	0.21	6	4	2	7	0.42	24
10	2	1	2	0.12	3	4	1	3	0.24	12
Total	n/a	200	298	**5.5**	393	n/a	200	466	**9.7**	1,113
	Players Advantage = 5.48 / 298 =			**1.84%**	SQRT:	Players Advantage = 9.71 / 466 =			**2.08%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**23.2**	20	Standard Deviation = SQRT(Tot (G5)) * 1.17			**39.0**	33
	Standard Deviation / Expected Win			**4.2**		Standard Deviation / Expected Win			**4.0**	

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
(Modified from Exhibit F1c, Truing the Red 7 count)

k = factor for doubles and splits
10% doubles, 2% splits, 0.6% DAS
k = 1.126

Exhibit F1a
Betting, S17, DAS, no LS
AACpTCp = 0.495% Idx = 0.81

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 A'				
(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	-	-	-	-	0	-	-	-	-
0	0	-	-	-	-	0	-	-	-	-
1	0	-	-	-	-	0	-	-	-	-
2	1	86	97	0.64	86	0	-	-	-	-
3	2	50	112	1.36	200	1	50	56	0.68	50
4	3	29	97	1.84	259	1	29	32	0.61	29
5	4	16	72	1.94	254	1	16	18	0.48	16
6	5	9	51	1.83	227	1	9	10	0.37	9
7	6	5	36	1.60	191	1	5	6	0.27	5
8	7	3	24	1.27	148	1	3	3	0.18	3
9	8	2	14	0.85	97	1	2	2	0.11	2
10	9	1	8	0.54	61	1	1	1	0.06	1
Total	n/a	200	510	**11.9**	1,522	n/a	114	129	**2.8**	114
	Players Advantage = 11.88 / 510 =			**2.33%**	SQRT:	Players Advantage = 2.76 / 129 =			**2.15%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**45.6**	39	Standard Deviation = SQRT(Tot (G5)) * 1.17			**12.5**	11
	Standard Deviation / Expected Win			**3.8**		Standard Deviation / Expected Win			**4.5**	

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
(Modified from Exhibit F1c, Truing the Red 7 count)

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) 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	0	-	-	-	-	0	-	-	-	-
3	1	50	56	0.68	50	1	50	56	0.68	50
4	2	29	65	1.23	115	2	29	65	1.23	115
5	2	16	36	0.97	64	3	16	54	1.45	143
6	2	9	20	0.73	36	4	9	41	1.47	145
7	2	5	12	0.53	21	4	5	24	1.06	85
8	2	3	7	0.36	12	4	3	14	0.73	48
9	2	2	3	0.21	6	4	2	7	0.42	24
10	2	1	2	0.12	3	4	1	3	0.24	12
Total	n/a	114	201	**4.8**	307	n/a	114	263	**7.3**	622
	Players Advantage = 4.84 / 201 =			**2.41%**	SQRT:	Players Advantage = 7.28 / 263 =			**2.77%**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**20.5**	18	Standard Deviation = SQRT(Tot (G5)) * 1.17			**29.2**	25
	Standard Deviation / Expected Win			**4.2**		Standard Deviation / Expected Win			**4.0**	

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

(Modified from Exhibit F1c, Truing the Red 7 count)

k = factor for doubles and splits		Exhibit F1a		u = units bet, freq(u) = frequency of "u" bets and W = amount won:	
10% doubles, 2% splits, 0.6% DAS		Betting, S17, DAS, no LS		SD(W) = SD(X) * SQRT(Sum [freq(u) * (u^2)])	
k =	1.126	AACpTCp =	0.495%	Idx =	0.81

where SD(X) = Standard Deviation of a single BJ hand = 1.17

	Betting Schedule D'					Betting Schedule XXX				
(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	-	-	-	-	#REF!	#REF!	#REF!	#REF!	#REF!
0	0	-	-	-	-	#REF!	#REF!	#REF!	#REF!	#REF!
1	0	-	-	-	-	#REF!	#REF!	#REF!	#REF!	#REF!
2	0	-	-	-	-	#REF!	#REF!	#REF!	#REF!	#REF!
3	1	50	56	0.68	50	#REF!	#REF!	#REF!	#REF!	#REF!
4	2	29	65	1.23	115	#REF!	#REF!	#REF!	#REF!	#REF!
5	3	16	54	1.45	143	#REF!	#REF!	#REF!	#REF!	#REF!
6	4	9	41	1.47	145	#REF!	#REF!	#REF!	#REF!	#REF!
7	5	5	30	1.33	132	#REF!	#REF!	#REF!	#REF!	#REF!
8	6	3	20	1.09	109	#REF!	#REF!	#REF!	#REF!	#REF!
9	7	2	12	0.74	74	#REF!	#REF!	#REF!	#REF!	#REF!
10	8	1	7	0.48	48	#REF!	#REF!	#REF!	#REF!	#REF!
Total	n/a	114	284	**8.5**	816	n/a	#REF!	#REF!	**#REF!**	#REF!
	Players Advantage = 8.47 / 284 =			**2.98%**	SQRT:		#REF!		**#REF!**	SQRT:
	Standard Deviation = SQRT(Tot (G5)) * 1.17			**33.4**	29	Standard Deviation = SQRT(Tot (G5)) * 1.17			**#REF!**	#REF!
	Standard Deviation / Expected Win			**3.9**		Standard Deviation / Expected Win			**#REF!**	

Analysis of Various Betting Schedules
Maximum Bet of 5 unts compared to Maximum Bet of 4 units
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
(Modified from Exhibit F1c, Truing the Red 7 count)

		1,000 hands back counted (265 hands played)				Day Trip: 200 hands played (756 hands back counted)			
		Maximum Bet of 4 units compared to Maximum Bet of 5 units				Maximum Bet of 4 units compared to Maximum Bet of 5 units			
		Number of Hands Back Counte			1,000	Number of Hands Back Counte			756
		Betting Schedule, Units Bet				Betting Schedule, Units Bet			
		Maximum Bet = 4 units		Maximum Bet = 5 units		Maximum Bet = 4 units		Maximum Bet = 5 units	
Red 7 "tc"	tot adv	C4	C4'	C5	C5'	C4	C4'	C5	C5'
-1	-0.90%	0	0	0	0	0	0	0	0
0	-0.40%	0	0	0	0	0	0	0	0
1	0.09%	0	0	0	0	0	0	0	0
2	0.66%	1	0	1	0	1	0	1	0
3	1.21%	2	1	2	1	2	1	2	1
4	1.90%	3	2	3	2	3	2	3	2
5	2.71%	4	3	4	3	4	3	4	3
6	3.59%	4	4	5	4	4	4	5	4
7	4.46%	4	4	5	5	4	4	5	5
8	5.34%	4	4	5	5	4	4	5	5
9	6.21%	4	4	5	5	4	4	5	5
10	7.09%	4	4	5	5	4	4	5	5
# hands played		265	151	265	151	200	114	200	114
Amount Bet		617	348	646	364	466	263	489	275
μ = Expected Win		12.8	9.6	14.1	10.4	9.7	7.3	10.7	7.9
% adv = E(win) / Bet		2.1%	2.8%	2.2%	2.9%	2.1%	2.8%	2.2%	2.9%
σ = Std Dev		44.9	33.6	48.3	36.0	39.0	29.2	42.0	31.3

Analysis of Various Betting Schedules
Variation of Expected Win and Standard Deviation with number of hands played

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Maximum Bet = 4 units						SQRT	SQRT
	C4	C4'	C4	C4'	(1)/(3)	(2)/(4)	((1)/(3))	((2)/(4))
h = # hands played	265	151	200	114	1.32	1.32	1.15	1.15
E(h)	12.8	9.6	9.7	7.3	1.32	1.32	n/a	n/a
SD(h)	44.9	33.6	39.0	29.2	1.15	1.15	n/a	n/a

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Maximum Bet = 5 units						SQRT	SQRT
	C5	C5'	C5	C5'	(1)/(3)	(2)/(4)	((1)/(3))	((2)/(4))
h = # hands played	265	151	200	114	1.32	1.32	1.15	1.15
E(h)	14.1	10.4	10.7	7.9	1.32	1.32	n/a	n/a
SD(h)	48.3	36.0	42.0	31.3	1.15	1.15	n/a	n/a

Note:

Let E(h) = expected win if "h" hands are played and SD(h) = standard deviation if "h" hands are played then:

(1) E(h1) = (h1/h2) * E*(h2)

As the number of hands increases, the expected win increases proportional to the increase in the number of hands.

(2) SD(h1) = SQRT(h1/h2) * SD*(h2)

As the number of hands increases, the standard deviation increases proportional to the square root of the number of hands.

So if the number of hands played quadruples, then the expected win quadruples but the standard deviation only doubles.

Example: 4 unit maximum betting schedule C4 with h1 = 265 hands played and h2 = 200 hands played

(1) E(h1) / E(h2) = E(265 hands) / E(200 hands) = (12.8 / 9.7) = 1.32 and (h1/h2) = (265/200) = 1.32

(2) SD(h1) / SD(h2) = SD(265 hands) / SD(200 hands) = (44.9 / 39.0) = 1.15 and SQRT(h1/h2) = SQRT(265/200) = SQRT(1.32) = 1.15

Exhibit 4C

Longest Day Trip losing streak from 100,000 Day Trip simulation
Betting Schedule C4

Unit bet size unchanged and 4 unit maximum bet unchanged irrespective of current bankroll

Initial Bankroll = 80 units, win = ending bankroll - initial bankroll

13 losing day trips in a row, followed by 60 more day trips until a final net win on day trip #74.

Trip #	ending bankroll	win	net win	Trip #	ending bankroll	win	net win	Trip #	ending bankroll	win	net win
1	66	-14	-14	26	46	-34	-185	51	80	0	-180
2	64	-16	-30	27	84	4	-181	52	96	16	-164
3	66	-14	-44	28	145	65	-116	53	69	-11	-175
4	39	-41	-85	29	73	-7	-123	54	53	-27	-202
5	78	-2	-87	30	91	11	-112	55	117	37	-165
6	79	-1	-88	31	44	-36	-148	56	67	-13	-178
7	72	-8	-96	32	81	1	-147	57	115	35	-143
8	64	-16	-112	33	78	-2	-149	58	92	12	-131
9	63	-17	-129	34	67	-13	-162	59	88	8	-123
10	58	-22	-151	35	95	15	-147	60	86	6	-117
11	76	-4	-155	36	0	-80	-227	61	101	21	-96
12	0	-80	-235	37	77	-3	-230	62	76	-4	-100
13	67	-13	-248	38	36	-44	-274	63	111	31	-69
14	169	89	-159	39	123	43	-231	64	29	-51	-120
15	68	-12	-171	40	134	54	-177	65	99	19	-101
16	65	-15	-186	41	107	27	-150	66	40	-40	-141
17	60	-20	-206	42	59	-21	-171	67	115	35	-106
18	130	50	-156	43	110	30	-141	68	118	38	-68
19	67	-13	-169	44	138	58	-83	69	95	15	-53
20	84	4	-165	45	53	-27	-110	70	111	31	-22
21	28	-52	-217	46	98	18	-92	71	76	-4	-26
22	122	42	-175	47	47	-33	-125	72	65	-15	-41
23	110	30	-145	48	93	13	-112	73	68	-12	-53
24	47	-33	-178	49	60	-20	-132	74	142	62	9
25	107	27	-151	50	32	-48	-180				

Suggested Day Trip Betting Schedules
Betting Schedules Vary by Size of Current Bankroll
Six Decks, 4.5 decks dealt

Suggested Day Trip Betting Schedule			
Initial Bankroll = 80 units			
Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 90	C5	5 units	6
72 < B <= 90	C4	4 units	5
60 < B <= 72	C3	3 units	4
B <= 60	C2	2 units	3

Day Trip: 200 hands played					
Number of Hands Back Counted			756		
Six Decks, 4.5 decks dealt		Betting Schedule, Units Bet			
Red 7 "tc"	tot adv	C2	C3	C4	C5
-1	-0.90%	0	0	0	0
0	-0.40%	0	0	0	0
1	0.09%	0	0	0	0
2	0.66%	1	1	1	1
3	1.21%	2	2	2	2
4	1.90%	2	3	3	3
5	2.71%	2	3	4	4
6	3.59%	2	3	4	5
7	4.46%	2	3	4	5
8	5.34%	2	3	4	5
9	6.21%	2	3	4	5
10	7.09%	2	3	4	5
# hands played		200	200	200	200
Amount Bet		354	426	466	489
μ = Expected Win		6.2	8.2	9.7	10.7
% adv = E(win) / Bet		1.7%	1.9%	2.1%	2.2%
σ = Std Dev		27.3	34.4	39.0	42.0

Suggested Bet, in units

Day Trip: 200 hands played					
Six Decks at the Three Deck Dealt Level					
Initial Bankroll = 80 units		B = Current Bankroll			
Red 7		C2	C3	C4	C5
run count	true count[1]	B <= 60	60 < B <= 72	72 < B <= 90	B > 90
12	2.0	1.0	1.0	1.0	1.0
13	2.3	1.5	1.5	1.5	1.5
14	2.7	1.5	1.5	1.5	1.5
15	3.0	2.0	2.0	2.0	2.0
16	3.3	2.0	2.5	2.5	2.5
17	3.7	2.0	2.5	2.5	2.5
18	4.0	2.0	3.0	3.0	3.0
19	4.3	2.0	3.0	3.5	3.5
20	4.7	2.0	3.0	3.5	3.5
21	5.0	2.0	3.0	4.0	4.0
22	5.3	2.0	3.0	4.0	4.5
23	5.7	2.0	3.0	4.0	4.5
>= 24	>= 6	2.0	3.0	4.0	5.0

[1] tc = 2 + (rc - 2*n) / dr. Here n = 6 decks and dr = 3, so tc = 2 + (rc - 12) / 3

Exhibit 4E

Risk of Ruin by Betting Schedule, Trip Duration and Bankroll
Six Decks, 4.5 Dealt
Unit bet size unchanged and maximum bet, in units, unchanged irrespective of current bankroll

Betting Schedule	4	(4 = C4, 3 = C3, 2 = C2, 1 = C1)
Trip Duration (hours)	8	
Bankroll	80	
Risk of Ruin	**2.4%**	

	Betting Schedule (Units Bet)			
Red 7 tc	C4	C3	C2	C1
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

$\mu(1)$ expected one hour win

$\sigma(1)$ one hour standard deviation

	Betting Schedule			
	1	2	3	4
$\mu(1)$	0.4	0.8	1.0	1.2
$\sigma(1)$	5.9	9.6	12.1	13.8

Note: $\mu(1)$, $\sigma(1)$ can be calculated from Exhibit 4A by entering 94 as the number of hands backcounted (94 hands backcounted gives 25 hands played) and typing in the betting schedule under consideration.

$\mu(1)$	1.2		$\sigma(1)$	13.8	
hours		$\mu(n) = n*\mu(1)$		$\mu(n)$	9.6
8		$\sigma(n) = \mathrm{SQRT}(n)*\sigma(1)$		$\sigma(n)$	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%**

Ending Bankroll Algorithm

80 unit bankroll, 200 hands played

Initial Bankroll 80

ending bk unmod	end bk mod #1
77	73
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

4.5 out of 6 decks dealt — Initial Bet = ib, col (5)

Red 7 "tc"	tot adv	Hand %	Cumulative	Cumulative	Randbetween(1,1000) = rb (col(4))	tc >= 6	tc	tot adv	p = 0.5 + (a/2)
2	0.66%	43.0%	430	430	rb <= 430 then ib = 1		2	0.66%	0.503
3	1.21%	24.9%	249	679	430 < rb <= 679 then ib = 2		3	1.21%	0.506
4	1.90%	14.3%	143	822	679 < rb <= 822 then ib = 3		4	1.90%	0.509
5	2.71%	7.9%	79	901	822 < rb <= 901 then ib = 4		5	2.71%	0.514
6	3.59%	4.5%	45	946	rb > 901 then ib = 5	3.59%	>=6	4.47%	0.522
7	4.46%	2.6%	26	972		4.46%			
8	5.34%	1.5%	15	987		5.34%			
9	6.21%	0.8%	8	995		6.21%			
10	7.09%	0.5%	5	1,000		7.09%			
Total		100.0%			Wtd Avg tot adv	4.47%			

p = prob of winning, a = player's advantage. p = (1 + a) / 2 = 0.5 + (a/2)

Suggested Day Trip Betting Schedule

Initial Bankroll = 80 units

Current Bankroll (B) in units	Betting Schedule	Maximum Bet	Maximum Bet at True Count >=
B > 90	C5	5 units	6
72 < B <= 90	C4	4 units	5
60 < B <= 72	C3	3 units	4
B <= 60	C2	2 units	3

Win = +1, Loss = -1 — Method 1: Unit Bet Size Constant, Betting Schedules C5, C4, C3 and C2

Hand #	(1) Randbetween (1,1000)	(2a) tc = 2 a = 0.66% If ((1)<=503,1,-1)	(2b) tc = 3 a = 1.21% If ((1)<=506,1,-1)	(2c) tc = 4 a = 1.90% If ((1)<=509,1,-1)	(2d) tc = 5 a = 2.71% If ((1)<=514,1,-1)	(2e) tc >= 6 a = 4.47% If ((1)<=522,1,-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)	Hand #	(10) = (5) Initial Bet	(11) Modified Initial Bet	(12) Modified Final Bet: Double if (7) > (5)	(13) Amount Won = (12)*SIGN(8)	(14) Bankroll (B) = B:prev + (12)
												80						80
1	467	1	1	1	1	1	329	1	61	1	1	81	1	1	1	1	1	81
2	157	1	1	1	1	1	963	5	21	5	5	86	2	5	4	4	4	85
3	248	1	1	1	1	1	603	2	41	2	2	88	3	2	2	2	2	87
4	792	-1	-1	-1	-1	-1	170	1	15	1	-1	87	4	1	1	1	-1	86
5	752	-1	-1	-1	-1	-1	970	5	76	5	-5	82	5	5	4	4	-4	82
6	162	1	1	1	1	1	951	5	51	5	5	87	6	5	4	4	4	86
7	256	1	1	1	1	1	282	1	64	1	1	88	7	1	1	1	1	87
8	861	-1	-1	-1	-1	-1	444	2	4	4	-4	84	8	2	2	4	-4	83
9	293	1	1	1	1	1	525	2	4	4	4	88	9	2	2	4	4	87
10	507	-1	-1	1	1	1	937	5	56	5	5	93	10	5	4	4	4	91
11	466	1	1	1	1	1	976	5	33	5	5	98	11	5	5	5	5	96
12	350	1	1	1	1	1	266	1	26	1	1	99	12	1	1	1	1	97
13	274	1	1	1	1	1	527	2	9	4	4	103	13	2	2	4	4	101
14	4	1	1	1	1	1	631	2	80	2	2	105	14	2	2	2	2	103
15	881	-1	-1	-1	-1	-1	56	1	3	2	-2	103	15	1	1	2	-2	101
16	834	-1	-1	-1	-1	-1	584	2	96	2	-2	101	16	2	2	2	-2	99
17	957	-1	-1	-1	-1	-1	168	1	87	1	-1	100	17	1	1	1	-1	98
18	581	-1	-1	-1	-1	-1	477	2	72	2	-2	98	18	2	2	2	-2	96
19	232	1	1	1	1	1	908	5	99	5	5	103	19	5	5	5	5	101
20	475	1	1	1	1	1	624	2	89	2	2	105	20	2	2	2	2	103
21	768	-1	-1	-1	-1	-1	133	1	33	1	-1	104	21	1	1	1	-1	102
22	276	1	1	1	1	1	855	4	13	4	4	108	22	4	4	4	4	106
23	730	-1	-1	-1	-1	-1	633	2	99	2	-2	106	23	2	2	2	-2	104
24	938	-1	-1	-1	-1	-1	790	3	92	3	-3	103	24	3	3	3	-3	101
25	141	1	1	1	1	1	129	1	43	1	1	104	25	1	1	1	1	102
26	442	1	1	1	1	1	39	1	17	1	1	105	26	1	1	1	1	103
27	751	-1	-1	-1	-1	-1	565	2	43	2	-2	103	27	2	2	2	-2	101
28	744	-1	-1	-1	-1	-1	897	4	66	4	-4	99	28	4	4	4	-4	97
29	699	-1	-1	-1	-1	-1	520	2	9	4	-4	95	29	2	2	4	-4	93
30	181	1	1	1	1	1	82	1	25	1	1	96	30	1	1	1	1	94

		Win = +1, Loss = -1												Method 1: Unit Bet Size Constant, Betting Schedules C5, C4, C3 and C2				
	(1)	(2a)	(2b)	(2c)	(2d)	(2e)	(4)	(5)	(6)	(7)	(8)	(9)		(10) = (5)	(11)	(12)	(13)	(14)
Hand #	Randbetween (1,1000)	tc = 2 a = 0.66% If ((1)<=503,1,-1)	tc = 3 a = 1.21% If ((1)<=506,1,-1)	tc = 4 a = 1.90% If ((1)<=509,1,-1)	tc = 5 a = 2.71% If ((1)<=514,1,-1)	tc >= 6 a = 4.47% If ((1)<=522,1,-1)	Randbetween (1,1000)	Initial Bet	Randbetween (1,100)	Final Bet: if (6) <= 12 Double	Amount Won = (7)*(2x)	Bankroll (B) = B:prev + (8)	Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)
31	179	1	1	1	1	1	734	3	68	3	3	99	31	3	3	3	3	97
32	965	-1	-1	-1	-1	-1	594	2	44	2	-2	97	32	2	2	2	-2	95
33	799	-1	-1	-1	-1	-1	154	1	19	1	-1	96	33	1	1	1	-1	94
34	766	-1	-1	-1	-1	-1	478	2	52	2	-2	94	34	2	2	2	-2	92
35	569	-1	-1	-1	-1	-1	795	3	80	3	-3	91	35	3	3	3	-3	89
36	117	1	1	1	1	1	46	1	27	1	1	92	36	1	1	1	1	90
37	54	1	1	1	1	1	756	3	36	3	3	95	37	3	3	3	3	93
38	578	-1	-1	-1	-1	-1	732	3	22	3	-3	92	38	3	3	3	-3	90
39	737	-1	-1	-1	-1	-1	343	1	88	1	-1	91	39	1	1	1	-1	89
40	589	-1	-1	-1	-1	-1	547	2	95	2	-2	89	40	2	2	2	-2	87
41	734	-1	-1	-1	-1	-1	60	1	38	1	-1	88	41	1	1	1	-1	86
42	800	-1	-1	-1	-1	-1	836	4	21	4	-4	84	42	4	4	4	-4	82
43	262	1	1	1	1	1	909	5	23	5	5	89	43	5	4	4	4	86
44	575	-1	-1	-1	-1	-1	255	1	39	1	-1	88	44	1	1	1	-1	85
45	863	-1	-1	-1	-1	-1	609	2	82	2	-2	86	45	2	2	2	-2	83
46	628	-1	-1	-1	-1	-1	682	3	23	3	-3	83	46	3	3	3	-3	80
47	173	1	1	1	1	1	22	1	38	1	1	84	47	1	1	1	1	81
48	285	1	1	1	1	1	647	2	59	2	2	86	48	2	2	2	2	83
49	483	1	1	1	1	1	573	2	2	4	4	90	49	2	2	4	4	87
50	325	1	1	1	1	1	930	5	6	10	10	100	50	5	4	8	8	95
51	464	1	1	1	1	1	895	4	59	4	4	104	51	4	4	4	4	99
52	127	1	1	1	1	1	395	1	9	2	2	106	52	1	1	2	2	101
53	338	1	1	1	1	1	119	1	42	1	1	107	53	1	1	1	1	102
54	511	-1	-1	-1	1	1	222	1	94	1	-1	106	54	1	1	1	-1	101
55	412	1	1	1	1	1	147	1	64	1	1	107	55	1	1	1	1	102
56	555	-1	-1	-1	-1	-1	960	5	27	5	-5	102	56	5	5	5	-5	97
57	874	-1	-1	-1	-1	-1	72	1	68	1	-1	101	57	1	1	1	-1	96
58	205	1	1	1	1	1	660	2	26	2	2	103	58	2	2	2	2	98
59	322	1	1	1	1	1	9	1	9	2	2	105	59	1	1	2	2	100
60	739	-1	-1	-1	-1	-1	46	1	21	1	-1	104	60	1	1	1	-1	99
61	416	1	1	1	1	1	577	2	56	2	2	106	61	2	2	2	2	101
62	235	1	1	1	1	1	2	1	31	1	1	107	62	1	1	1	1	102
63	224	1	1	1	1	1	66	1	37	1	1	108	63	1	1	1	1	103
64	809	-1	-1	-1	-1	-1	15	1	68	1	-1	107	64	1	1	1	-1	102
65	288	1	1	1	1	1	730	3	49	3	3	110	65	3	3	3	3	105
66	782	-1	-1	-1	-1	-1	617	2	16	2	-2	108	66	2	2	2	-2	103
67	855	-1	-1	-1	-1	-1	800	3	33	3	-3	105	67	3	3	3	-3	100
68	156	1	1	1	1	1	829	4	7	8	8	113	68	4	4	8	8	108
69	417	1	1	1	1	1	514	2	32	2	2	115	69	2	2	2	2	110
70	963	-1	-1	-1	-1	-1	886	4	24	4	-4	111	70	4	4	4	-4	106
71	560	-1	-1	-1	-1	-1	745	3	65	3	-3	108	71	3	3	3	-3	103
72	728	-1	-1	-1	-1	-1	920	5	30	5	-5	103	72	5	5	5	-5	98
73	341	1	1	1	1	1	423	1	69	1	1	104	73	1	1	1	1	99
74	294	1	1	1	1	1	145	1	55	1	1	105	74	1	1	1	1	100
75	704	-1	-1	-1	-1	-1	952	5	16	5	-5	100	75	5	5	5	-5	95
76	13	1	1	1	1	1	875	4	81	4	4	104	76	4	4	4	4	99
77	277	1	1	1	1	1	404	1	73	1	1	105	77	1	1	1	1	100
78	923	-1	-1	-1	-1	-1	846	4	79	4	-4	101	78	4	4	4	-4	96
79	374	1	1	1	1	1	336	1	9	2	2	103	79	1	1	2	2	98
80	81	1	1	1	1	1	903	5	100	5	5	108	80	5	5	5	5	103

		Win = +1, Loss = -1												Method 1: Unit Bet Size Constant, Betting Schedules C5, C4, C3 and C2				
	(1)	(2a)	(2b)	(2c)	(2d)	(2e)	(4)	(5)	(6)	(7)	(8)	(9)		(10) = (5)	(11)	(12)	(13)	(14)
Hand #	Randbetween (1,1000)	tc = 2 a = 0.66% If ((1)<=503,1,-1)	tc = 3 a = 1.21% If ((1)<=506,1,-1)	tc = 4 a = 1.90% If ((1)<=509,1,-1)	tc = 5 a = 2.71% If ((1)<=514,1,-1)	tc >= 6 a = 4.47% If ((1)<=522,1,-1)	Randbetween (1,1000)	Initial Bet	Randbetween (1,100)	Final Bet: if (6) <= 12 Double	Amount Won = (7)*(2x)	Bankroll (B) = B:prev + (8)	Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)
81	622	-1	-1	-1	-1	-1	176	1	26	1	-1	107	81	1	1	1	-1	102
82	590	-1	-1	-1	-1	-1	971	5	61	5	-5	102	82	5	5	5	-5	97
83	541	-1	-1	-1	-1	-1	101	1	86	1	-1	101	83	1	1	1	-1	96
84	986	-1	-1	-1	-1	-1	434	2	68	2	-2	99	84	2	2	2	-2	94
85	835	-1	-1	-1	-1	-1	193	1	52	1	-1	98	85	1	1	1	-1	93
86	248	1	1	1	1	1	193	1	37	1	1	99	86	1	1	1	1	94
87	182	1	1	1	1	1	581	2	92	2	2	101	87	2	2	2	2	96
88	678	-1	-1	-1	-1	-1	962	5	62	5	-5	96	88	5	5	5	-5	91
89	834	-1	-1	-1	-1	-1	194	1	40	1	-1	95	89	1	1	1	-1	90
90	350	1	1	1	1	1	633	2	97	2	2	97	90	2	2	2	2	92
91	983	-1	-1	-1	-1	-1	159	1	56	1	-1	96	91	1	1	1	-1	91
92	649	-1	-1	-1	-1	-1	269	1	30	1	-1	95	92	1	1	1	-1	90
93	386	1	1	1	1	1	514	2	56	2	2	97	93	2	2	2	2	92
94	485	1	1	1	1	1	627	2	30	2	2	99	94	2	2	2	2	94
95	356	1	1	1	1	1	285	1	86	1	1	100	95	1	1	1	1	95
96	900	-1	-1	-1	-1	-1	936	5	74	5	-5	95	96	5	5	5	-5	90
97	764	-1	-1	-1	-1	-1	5	1	96	1	-1	94	97	1	1	1	-1	89
98	152	1	1	1	1	1	618	2	99	2	2	96	98	2	2	2	2	91
99	755	-1	-1	-1	-1	-1	758	3	96	3	-3	93	99	3	3	3	-3	88
100	457	1	1	1	1	1	628	2	74	2	2	95	100	2	2	2	2	90
101	998	-1	-1	-1	-1	-1	239	1	72	1	-1	94	101	1	1	1	-1	89
102	837	-1	-1	-1	-1	-1	178	1	98	1	-1	93	102	1	1	1	-1	88
103	195	1	1	1	1	1	549	2	55	2	2	95	103	2	2	2	2	90
104	92	1	1	1	1	1	960	5	63	5	5	100	104	5	4	4	4	94
105	957	-1	-1	-1	-1	-1	54	1	1	2	-2	98	105	1	1	2	-2	92
106	145	1	1	1	1	1	577	2	66	2	2	100	106	2	2	2	2	94
107	810	-1	-1	-1	-1	-1	413	1	9	2	-2	98	107	1	1	2	-2	92
108	707	-1	-1	-1	-1	-1	369	1	58	1	-1	97	108	1	1	1	-1	91
109	509	-1	-1	1	1	1	78	1	22	1	-1	96	109	1	1	1	-1	90
110	854	-1	-1	-1	-1	-1	603	2	87	2	-2	94	110	2	2	2	-2	88
111	932	-1	-1	-1	-1	-1	42	1	44	1	-1	93	111	1	1	1	-1	87
112	258	1	1	1	1	1	455	2	30	2	2	95	112	2	2	2	2	89
113	412	1	1	1	1	1	978	5	26	5	5	100	113	5	4	4	4	93
114	230	1	1	1	1	1	111	1	54	1	1	101	114	1	1	1	1	94
115	468	1	1	1	1	1	570	2	98	2	2	103	115	2	2	2	2	96
116	515	-1	-1	-1	-1	1	818	3	86	3	-3	100	116	3	3	3	-3	93
117	398	1	1	1	1	1	720	3	53	3	3	103	117	3	3	3	3	96
118	629	-1	-1	-1	-1	-1	35	1	93	1	-1	102	118	1	1	1	-1	95
119	882	-1	-1	-1	-1	-1	546	2	81	2	-2	100	119	2	2	2	-2	93
120	973	-1	-1	-1	-1	-1	378	1	40	1	-1	99	120	1	1	1	-1	92
121	505	-1	1	1	1	1	85	1	8	2	-2	97	121	1	1	2	-2	90
122	150	1	1	1	1	1	285	1	67	1	1	98	122	1	1	1	1	91
123	212	1	1	1	1	1	912	5	27	5	5	103	123	5	5	5	5	96
124	414	1	1	1	1	1	515	2	69	2	2	105	124	2	2	2	2	98
125	314	1	1	1	1	1	462	2	44	2	2	107	125	2	2	2	2	100
126	295	1	1	1	1	1	801	3	48	3	3	110	126	3	3	3	3	103
127	328	1	1	1	1	1	45	1	7	2	2	112	127	1	1	2	2	105
128	441	1	1	1	1	1	298	1	49	1	1	113	128	1	1	1	1	106
129	24	1	1	1	1	1	106	1	35	1	1	114	129	1	1	1	1	107
130	468	1	1	1	1	1	641	2	68	2	2	116	130	2	2	2	2	109

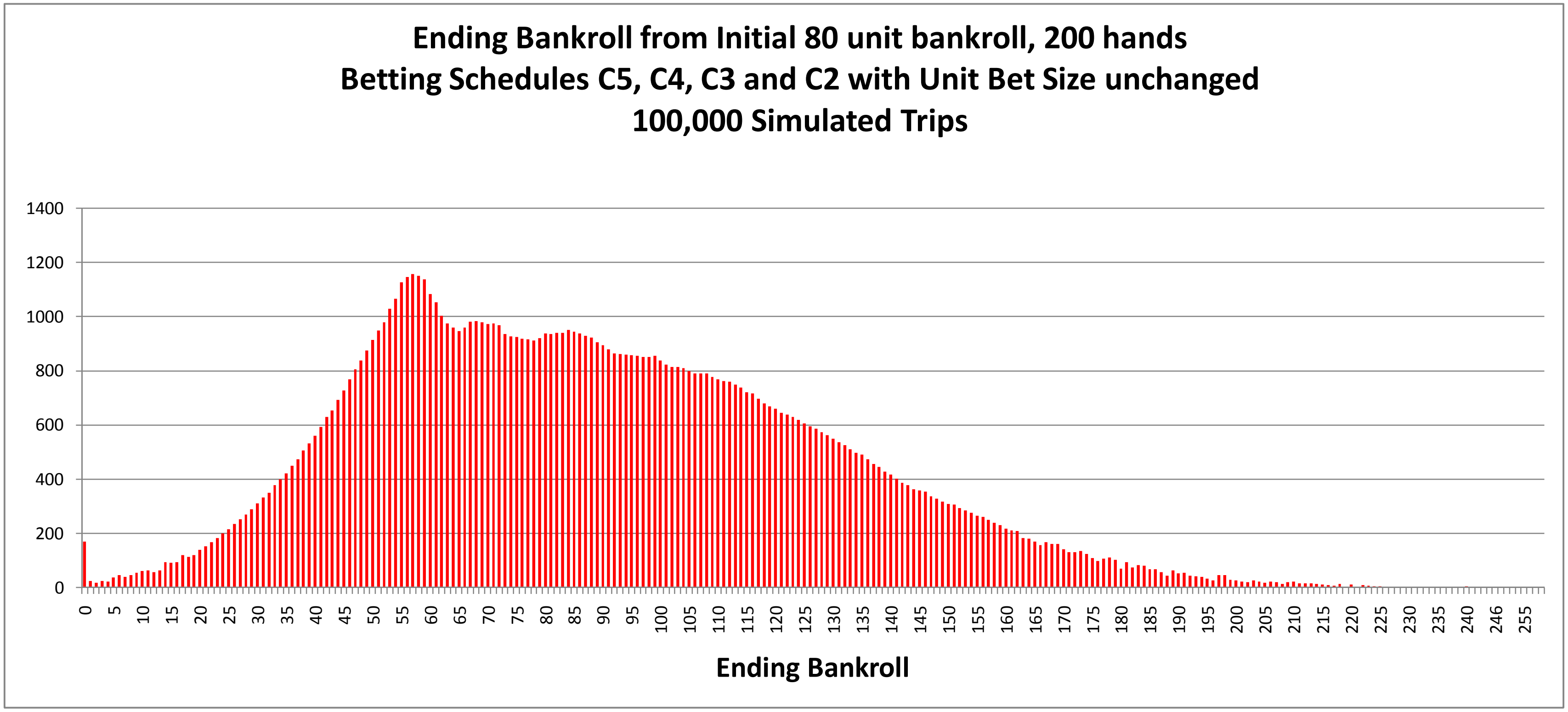
		Win = +1, Loss = -1												Method 1: Unit Bet Size Constant, Betting Schedules C5, C4, C3 and C2				
	(1)	(2a)	(2b)	(2c)	(2d)	(2e)	(4)	(5)	(6)	(7)	(8)	(9)		(10) = (5)	(11)	(12)	(13)	(14)
Hand #	Randbetween (1,1000)	tc = 2 a = 0.66% If ((1)<=503,1,-1)	tc = 3 a = 1.21% If ((1)<=506,1,-1)	tc = 4 a = 1.90% If ((1)<=509,1,-1)	tc = 5 a = 2.71% If ((1)<=514,1,-1)	tc >= 6 a = 4.47% If ((1)<=522,1,-1)	Randbetween (1,1000)	Initial Bet	Randbetween (1,100)	Final Bet: if (6) <= 12 Double	Amount Won = (7)*(2x)	Bankroll (B) = B:prev + (8)	Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)
131	248	1	1	1	1	1	373	1	15	1	1	117	131	1	1	1	1	110
132	812	-1	-1	-1	-1	-1	264	1	74	1	-1	116	132	1	1	1	-1	109
133	601	-1	-1	-1	-1	-1	783	3	57	3	-3	113	133	3	3	3	-3	106
134	697	-1	-1	-1	-1	-1	706	3	32	3	-3	110	134	3	3	3	-3	103
135	138	1	1	1	1	1	653	2	29	2	2	112	135	2	2	2	2	105
136	312	1	1	1	1	1	839	4	7	8	8	120	136	4	4	8	8	113
137	681	-1	-1	-1	-1	-1	54	1	70	1	-1	119	137	1	1	1	-1	112
138	707	-1	-1	-1	-1	-1	504	2	1	4	-4	115	138	2	2	4	-4	108
139	625	-1	-1	-1	-1	-1	885	4	80	4	-4	111	139	4	4	4	-4	104
140	211	1	1	1	1	1	800	3	3	6	6	117	140	3	3	6	6	110
141	258	1	1	1	1	1	610	2	8	4	4	121	141	2	2	4	4	114
142	976	-1	-1	-1	-1	-1	192	1	4	2	-2	119	142	1	1	2	-2	112
143	674	-1	-1	-1	-1	-1	497	2	12	4	-4	115	143	2	2	4	-4	108
144	179	1	1	1	1	1	476	2	18	2	2	117	144	2	2	2	2	110
145	616	-1	-1	-1	-1	-1	792	3	21	3	-3	114	145	3	3	3	-3	107
146	575	-1	-1	-1	-1	-1	815	3	91	3	-3	111	146	3	3	3	-3	104
147	273	1	1	1	1	1	602	2	97	2	2	113	147	2	2	2	2	106
148	547	-1	-1	-1	-1	-1	726	3	43	3	-3	110	148	3	3	3	-3	103
149	261	1	1	1	1	1	936	5	82	5	5	115	149	5	5	5	5	108
150	422	1	1	1	1	1	977	5	72	5	5	120	150	5	5	5	5	113
151	533	-1	-1	-1	-1	-1	670	2	23	2	-2	118	151	2	2	2	-2	111
152	736	-1	-1	-1	-1	-1	365	1	80	1	-1	117	152	1	1	1	-1	110
153	339	1	1	1	1	1	428	1	84	1	1	118	153	1	1	1	1	111
154	714	-1	-1	-1	-1	-1	146	1	24	1	-1	117	154	1	1	1	-1	110
155	23	1	1	1	1	1	988	5	36	5	5	122	155	5	5	5	5	115
156	773	-1	-1	-1	-1	-1	786	3	6	6	-6	116	156	3	3	6	-6	109
157	591	-1	-1	-1	-1	-1	566	2	63	2	-2	114	157	2	2	2	-2	107
158	157	1	1	1	1	1	694	3	21	3	3	117	158	3	3	3	3	110
159	800	-1	-1	-1	-1	-1	475	2	62	2	-2	115	159	2	2	2	-2	108
160	699	-1	-1	-1	-1	-1	489	2	94	2	-2	113	160	2	2	2	-2	106
161	178	1	1	1	1	1	225	1	58	1	1	114	161	1	1	1	1	107
162	772	-1	-1	-1	-1	-1	384	1	3	2	-2	112	162	1	1	2	-2	105
163	547	-1	-1	-1	-1	-1	226	1	10	2	-2	110	163	1	1	2	-2	103
164	393	1	1	1	1	1	158	1	9	2	2	112	164	1	1	2	2	105
165	208	1	1	1	1	1	724	3	79	3	3	115	165	3	3	3	3	108
166	766	-1	-1	-1	-1	-1	89	1	55	1	-1	114	166	1	1	1	-1	107
167	427	1	1	1	1	1	316	1	52	1	1	115	167	1	1	1	1	108
168	760	-1	-1	-1	-1	-1	26	1	78	1	-1	114	168	1	1	1	-1	107
169	244	1	1	1	1	1	637	2	82	2	2	116	169	2	2	2	2	109
170	579	-1	-1	-1	-1	-1	960	5	7	10	-10	106	170	5	5	10	-10	99
171	918	-1	-1	-1	-1	-1	332	1	86	1	-1	105	171	1	1	1	-1	98
172	203	1	1	1	1	1	791	3	54	3	3	108	172	3	3	3	3	101
173	83	1	1	1	1	1	47	1	27	1	1	109	173	1	1	1	1	102
174	690	-1	-1	-1	-1	-1	359	1	25	1	-1	108	174	1	1	1	-1	101
175	844	-1	-1	-1	-1	-1	84	1	38	1	-1	107	175	1	1	1	-1	100
176	128	1	1	1	1	1	250	1	40	1	1	108	176	1	1	1	1	101
177	8	1	1	1	1	1	257	1	5	2	2	110	177	1	1	2	2	103
178	960	-1	-1	-1	-1	-1	445	2	24	2	-2	108	178	2	2	2	-2	101
179	841	-1	-1	-1	-1	-1	531	2	34	2	-2	106	179	2	2	2	-2	99
180	332	1	1	1	1	1	228	1	90	1	1	107	180	1	1	1	1	100

		Win = +1, Loss = -1												Method 1: Unit Bet Size Constant, Betting Schedules C5, C4, C3 and C2				
	(1)	(2a)	(2b)	(2c)	(2d)	(2e)	(4)	(5)	(6)	(7)	(8)	(9)		(10) = (5)	(11)	(12)	(13)	(14)
Hand #	Randbetween (1,1000)	tc = 2 a = 0.66% If ((1)<=503,1,-1)	tc = 3 a = 1.21% If ((1)<=506,1,-1)	tc = 4 a = 1.90% If ((1)<=509,1,-1)	tc = 5 a = 2.71% If ((1)<=514,1,-1)	tc >= 6 a = 4.47% If ((1)<=522,1,-1)	Randbetween (1,1000)	Initial Bet	Randbetween (1,100)	Final Bet: if (6) <= 12 Double	Amount Won = (7)*(2x)	Bankroll (B) = B:prev + (8)	Hand #	Initial Bet	Modified Initial Bet	Modified Final Bet: Double if (7) > (5)	Amount Won = (12)*SIGN(8)	Bankroll (B) = B:prev + (12)
181	755	-1	-1	-1	-1	-1	200	1	32	1	-1	106	181	1	1	1	-1	99
182	897	-1	-1	-1	-1	-1	72	1	46	1	-1	105	182	1	1	1	-1	98
183	873	-1	-1	-1	-1	-1	650	2	90	2	-2	103	183	2	2	2	-2	96
184	527	-1	-1	-1	-1	-1	137	1	2	2	-2	101	184	1	1	2	-2	94
185	542	-1	-1	-1	-1	-1	968	5	88	5	-5	96	185	5	5	5	-5	89
186	766	-1	-1	-1	-1	-1	964	5	34	5	-5	91	186	5	4	4	-4	85
187	389	1	1	1	1	1	684	3	47	3	3	94	187	3	3	3	3	88
188	557	-1	-1	-1	-1	-1	859	4	89	4	-4	90	188	4	4	4	-4	84
189	868	-1	-1	-1	-1	-1	226	1	24	1	-1	89	189	1	1	1	-1	83
190	364	1	1	1	1	1	359	1	78	1	1	90	190	1	1	1	1	84
191	826	-1	-1	-1	-1	-1	369	1	11	2	-2	88	191	1	1	2	-2	82
192	356	1	1	1	1	1	510	2	22	2	2	90	192	2	2	2	2	84
193	138	1	1	1	1	1	225	1	40	1	1	91	193	1	1	1	1	85
194	753	-1	-1	-1	-1	-1	120	1	41	1	-1	90	194	1	1	1	-1	84
195	654	-1	-1	-1	-1	-1	581	2	37	2	-2	88	195	2	2	2	-2	82
196	559	-1	-1	-1	-1	-1	319	1	84	1	-1	87	196	1	1	1	-1	81
197	470	1	1	1	1	1	792	3	59	3	3	90	197	3	3	3	3	84
198	681	-1	-1	-1	-1	-1	243	1	72	1	-1	89	198	1	1	1	-1	83
199	727	-1	-1	-1	-1	-1	918	5	12	10	-10	79	199	5	4	8	-8	75
200	824	-1	-1	-1	-1	-1	490	2	40	2	-2	77	200	2	2	2	-2	73
											minimum	77					minimum	73

unmod	min unmod *	end bk mod #1	min mod #1 *
77	77	73	73

*Notes: (1) If minimum bankroll < 0 then bankruptcy occurred during the day trip even if ending bankroll > 0. This is because once the bankroll < 0 at any point during the day trip, there is no money left to bet to eventually bring the ending bankroll > 0. Only the ending bankrolls were used and so some of the ending bankrolls > 0 could have been less than zero at some point during the day trip and so were really bankruptcies. Bankruptcy really occurred if min bankroll < 0, not ending bankroll < 0. Thus Risk of Ruin is slightly underestimated in this simulation.
Also no adjustments to the suggested bet size were made when the bankroll was small. For example, if the bankroll was 2 units and the required bet was 3 units, the 3 units was allowed to be bet and if won the bankroll was larger than it should have been. In this case with a win of 3 units with a bank of 2 units resulted in a bank of 5 units. But only 2 units should have been bet since 2 units was the current bankroll so the bankroll should have been 4 units and not 5 units after that win. With a bankroll slightly larger than it should have been, it is possible that this extra unit would have help reduce a possible bankruptcy. This effect is very negligible but is noted for the sake of being complete.
The Risk of Ruin simulation in Exhibit F1c of Truing the Red 7 count did take into account the minimum bankroll and so was done correctly (except for the negligible effect of not capping the bet to the bankroll when the bankroll was small as mentioned above).
However, the approximation in this Exhibit of using only the ending bankrolls resulted in only a slight underestimate in the Risk of Ruin since it was used only for the modified betting schedules (the current bankroll taken into account in determining the bet size) and so the Risk of Ruins were typically under 1% for simulations that this algorithm was used for. With such a small Risk of Ruin, the use of ending bankrolls did not introduce any material errors.

(2) This exhibit does not take into account DAS or re-splitting so if DAS and/or re-splitting is allowed then there will be more variance in ending bankrolls than shown here giving an additional reason to cap your maximum bet at 4 units. Column (7) of this exhibit shows that the total bet is doubled 12% of the time. This reflects that doubling occurs approximately 10% of the time and splitting occurs approximately 2% of the time so that 12% of the time the total bet is doubled. This does not reflect extra bets made from DAS and/or re-splitting as mentioned above. Also, as shown in columns (2a) through (2e), pushes are ignored, the simulation showing that a bet is either won or lost. So the day trip is actually 200 hands played with an actual win or loss decision on each of these 200 hands so that pushes are not counted as part of the 200 hands played.



Initial Bank = 80 units

	Red 7 True Count				
Bet Sch	2	3	4	5	>=6
C5	1	2	3	4	5
C4	1	2	3	4	4
C3	1	2	3	3	3
C2	1	2	2	2	2

Betting Schedule C5:
(Current Bank) > 90 units

Betting Schedule C4:
72 units < (Current Bank) <= 90 units

Betting Schedule C3:
60 units < (Cur Bank) <= 72 units

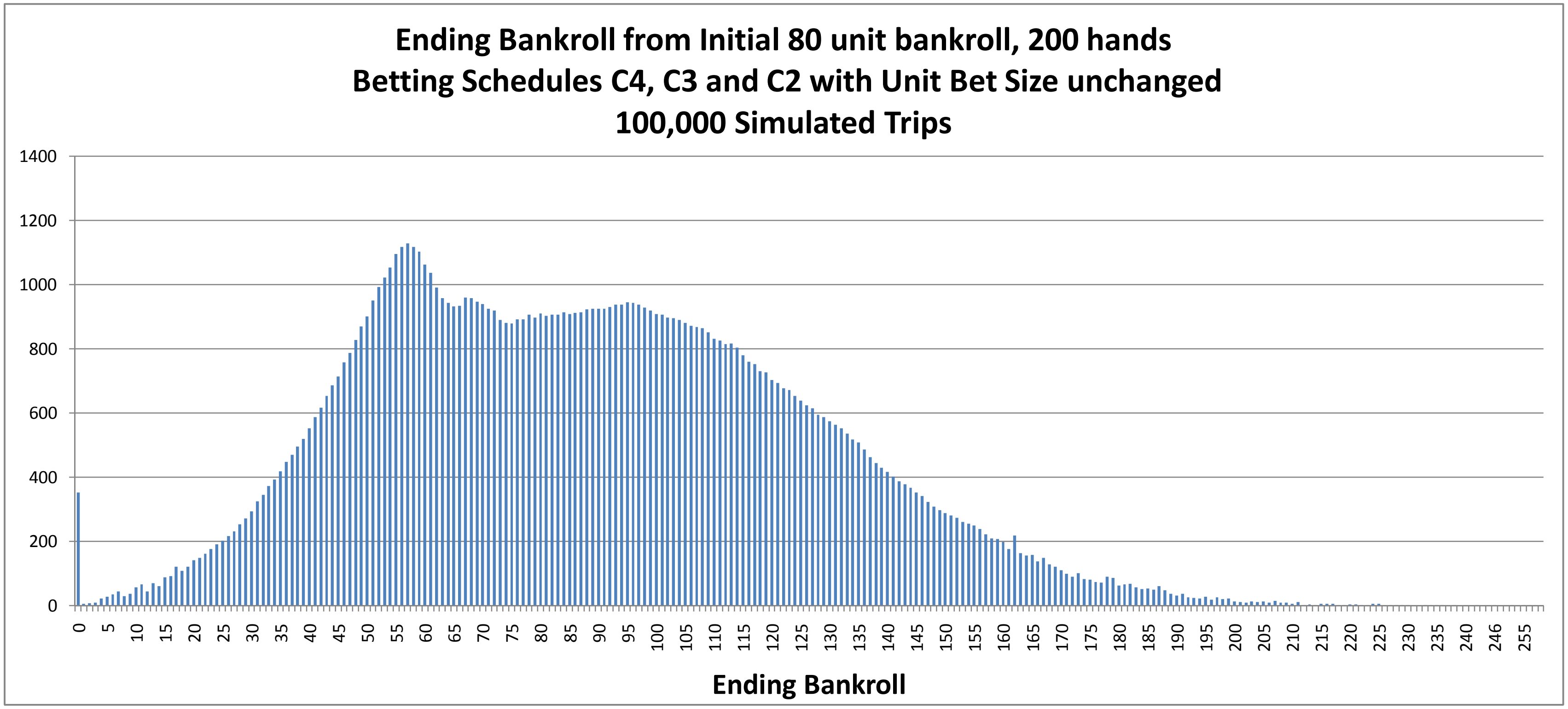
Betting Schedule C2:
(Current Bank) <= 60 units

100,000 day trip simulation:

Number of Day Trips ending in bankruptcy	169
Mean	89.1
Standard Deviation	38.5

Skew	0.446
Kurtosis *	-0.132

* 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
C4	1	2	3	4
C3	1	2	3	3
C2	1	2	2	2

Betting Schedule C4:
(Current Bank) > 72 units

Betting Schedule C3:
60 units < (Cur Bank) <= 72 units

Betting Schedule C2:
(Current Bank) <= 60 units

100,000 day trip simulation:

Number of Day Trips ending in bankruptcy	352
Mean	88.6
Standard Deviation	37.1

Skew	0.334
Kurtosis *	-0.271

* Excel function "KURT" subtracts "3" so normal distribution has Excel KURT = 0.

Betting Schedule Comparisons

#1: Switching betting schedules C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 5 units at true counts >= 6 when day trip bankroll > 90 units

#2: Switching betting schedules C4, C3 and C2 based on size of curent bankroll

#3: Constant 1-4 bet spread, irrespective of size of current bankroll.

100,000 day trip simulation:	#1	#2	#3
Number of Day Trips ending in bankruptcy	169	352	2,237
Mean	89.1	88.6	89.5
Standard Deviation	38.5	37.1	38.9
Skew	0.446	0.334	0.007
Kurtosis *	-0.132	-0.271	-0.025

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

#1 has fewer medium size wins and more extreme large wins than #2

Betting #1 compared to Betting #2

(1) #1 has a lower risk of ruin

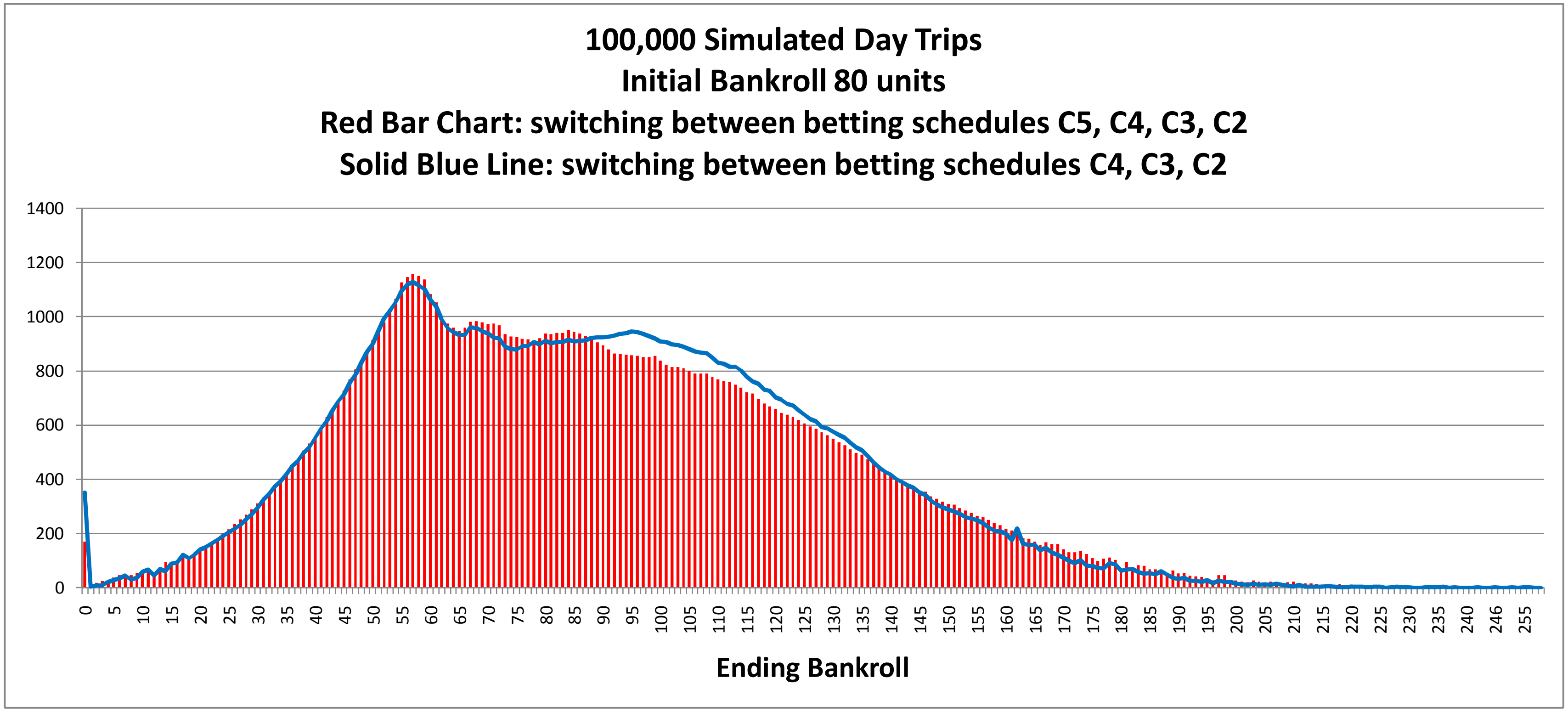
(2) #1 has a higher expected win

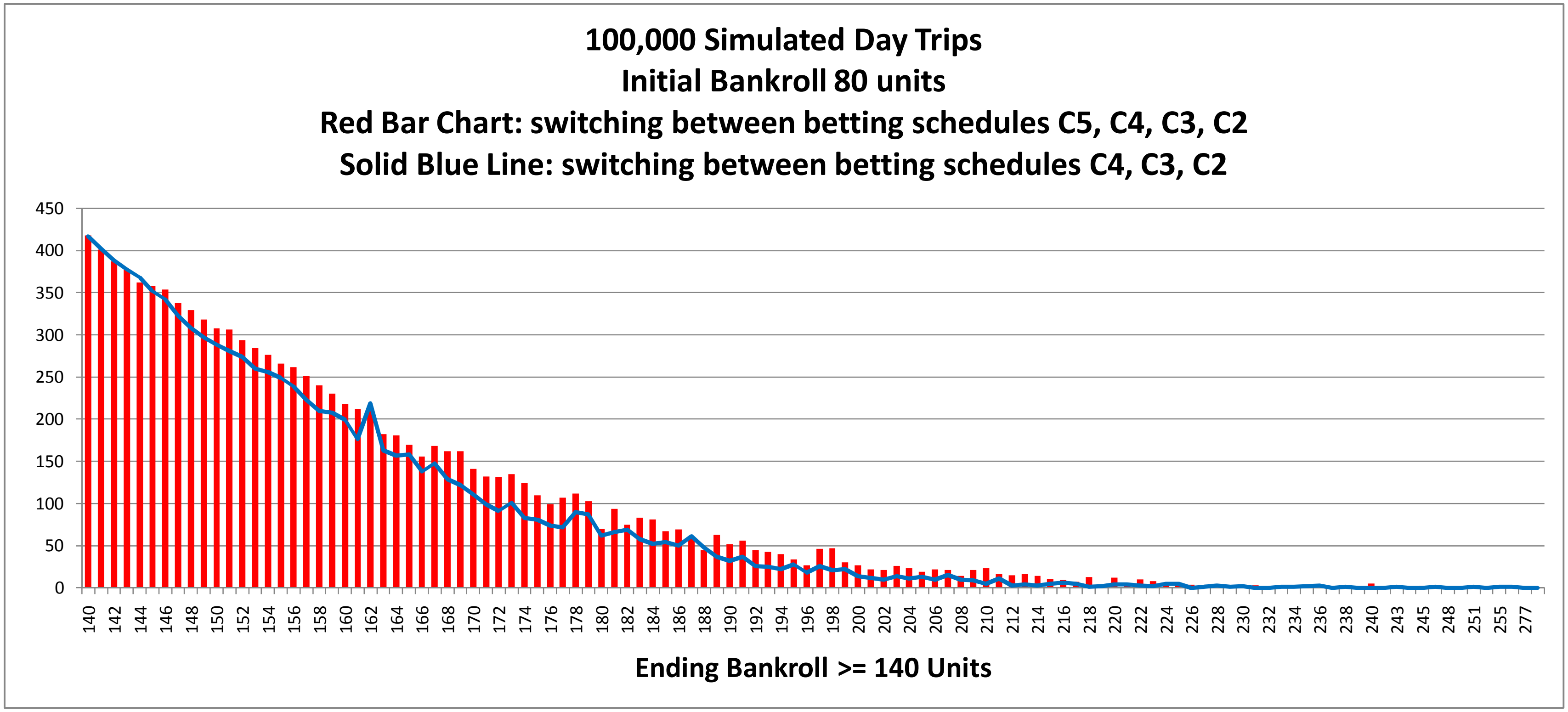
(3) #1 has a slightly higher standard deviation

(4) #1 is more highly skewed to the right (longer right tail):

#1 has less ending bankrolls in the 90 to 140 range but

more ending bankrolls over 150 units.




100,000 Simulated Day Trips
Initial Bankroll 80 units
Red Bar Chart: switching between betting schedules C5, C4, C3, C2
Solid Blue Line: switching between betting schedules C4, C3, C2
450
400
350
300
250
200
150
100
50
0
140
142
144
146
148
150
152
154
156
158
160
162
164
166
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184
186
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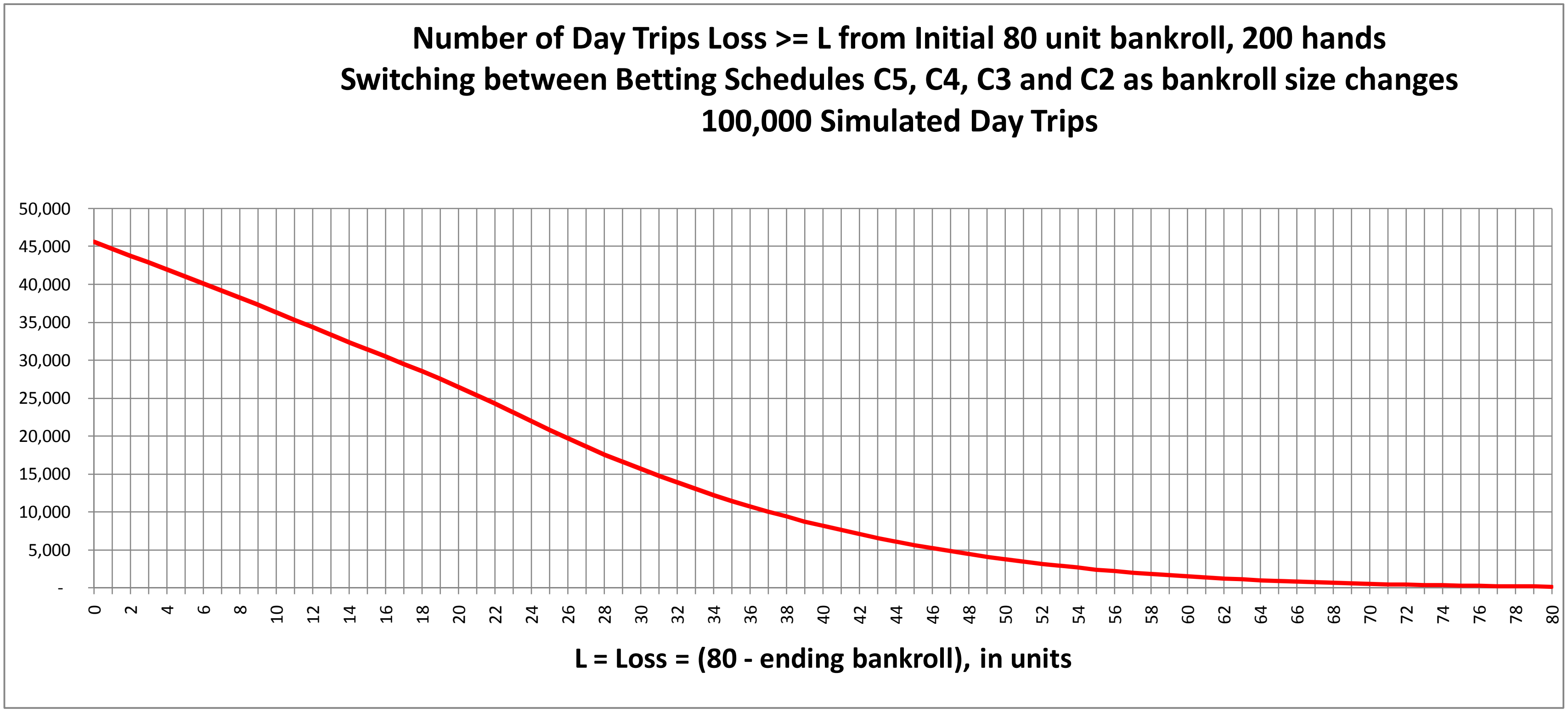
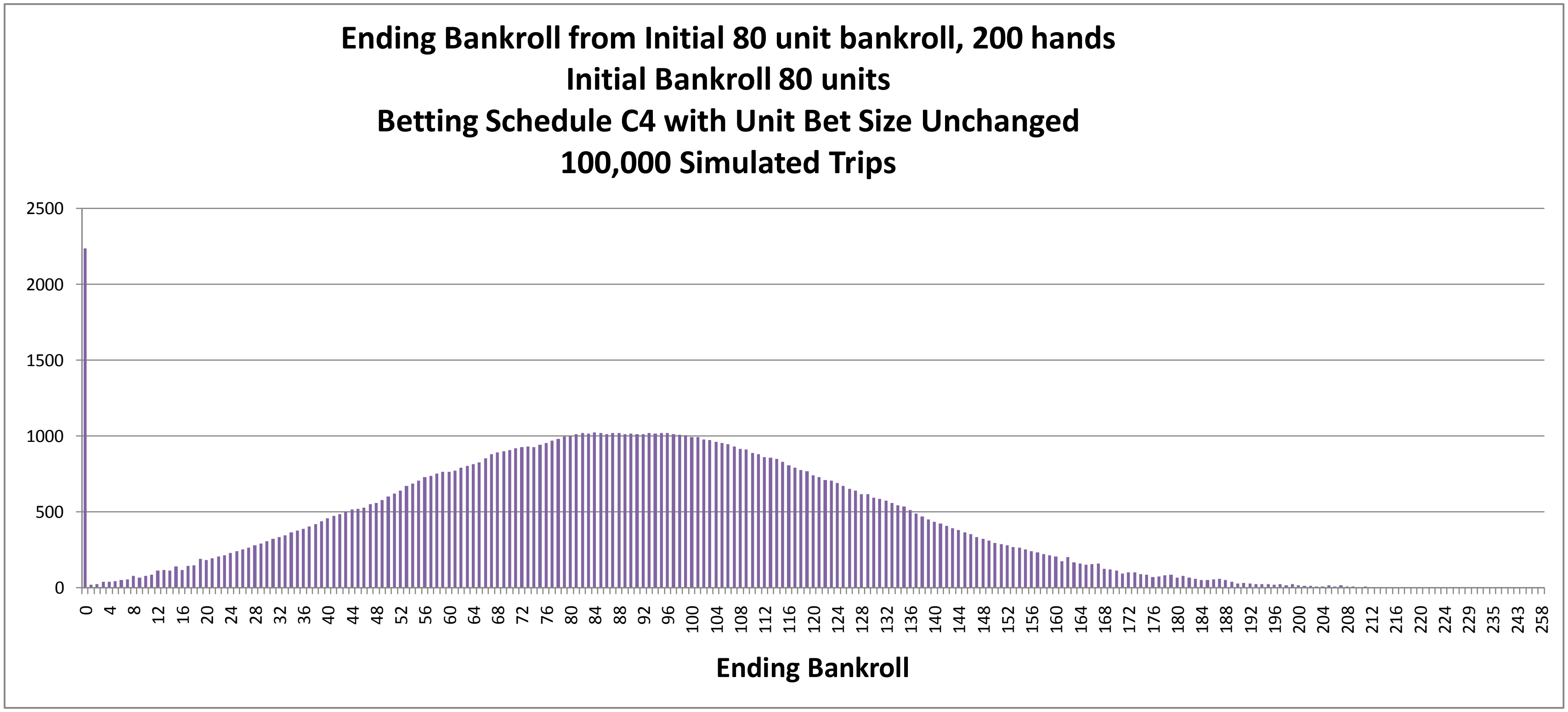
243
245
248
251
255
277
Ending Bankroll >= 140 Units



Notes:

(1) Prob(Losing Trip) = Prob(Loss > 0 unit) = Prob(Loss >= 1 unit) ≈ 45,000 out of 100,000 day trips from above graph ≈ 45%.

(2) Unit Bet = $25 and Loss = $1,100 for the day trip. Switching between betting schedules C5, C4, C3, C2 as described above. What is Prob(Loss >= $1,100)?
$1,100 dollar loss at $25 a unit is a loss of 44 units. P(Loss >= 44 units) ≈ 6,000 out of the 100,000 day trips from above graph ≈ 6%.

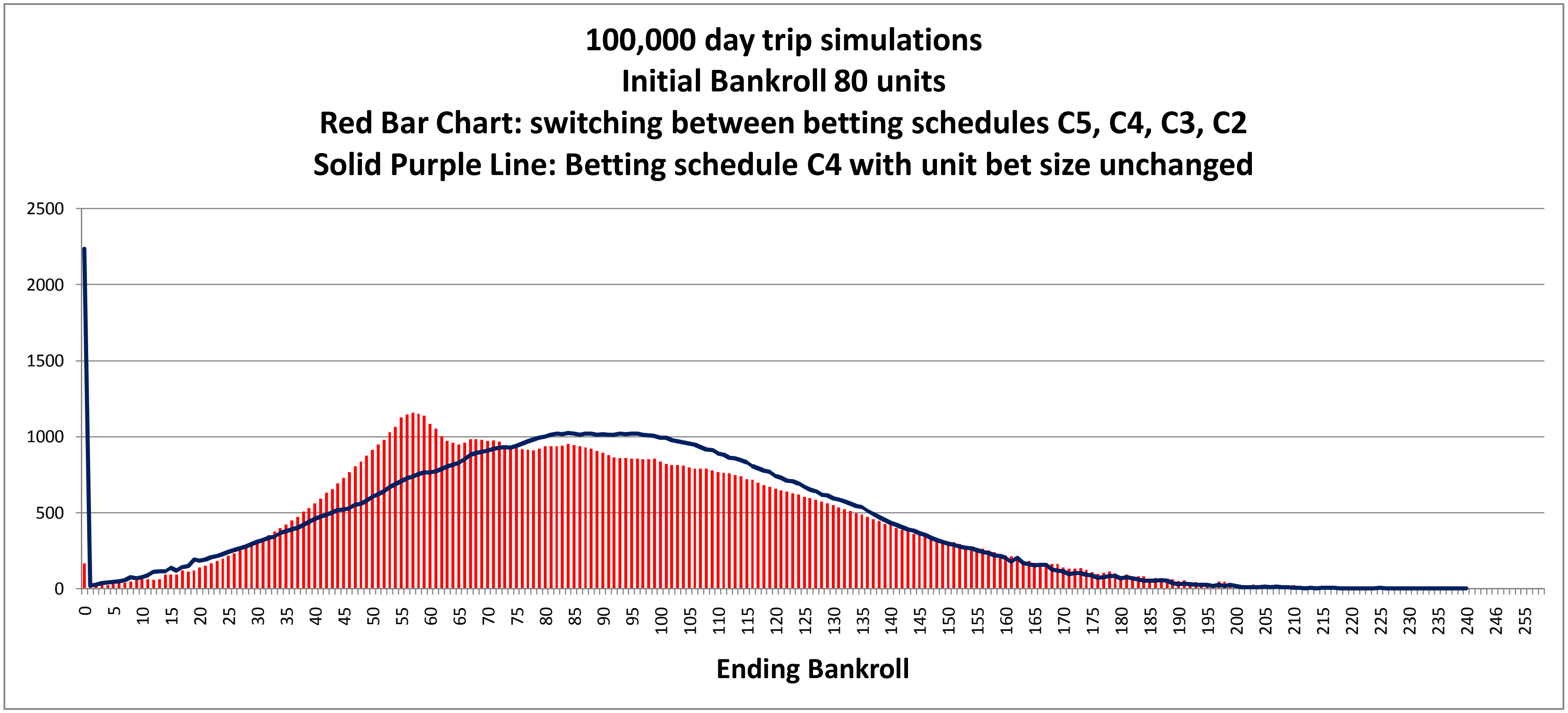


Initial Bank = 80 units

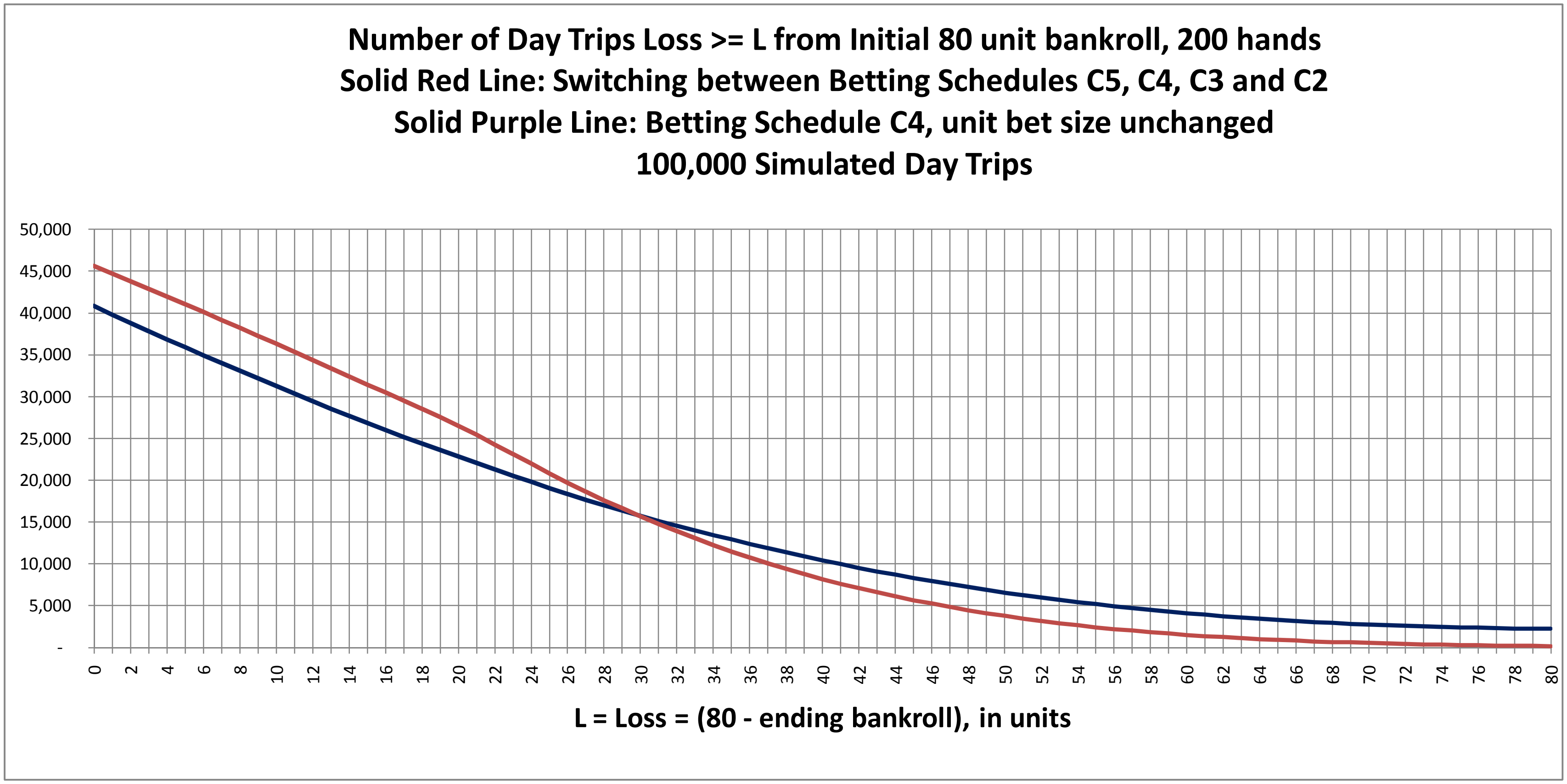
	Red 7 True Count			
Bet Sch	2	3	4	>= 5
C4	1	2	3	4

100,000 day trip simulation:	
Number of Day Trips ending in bankruptcy	2,237
Mean	89.5
Standard Deviation	38.9
Skew	0.007
Kurtosis *	-0.025

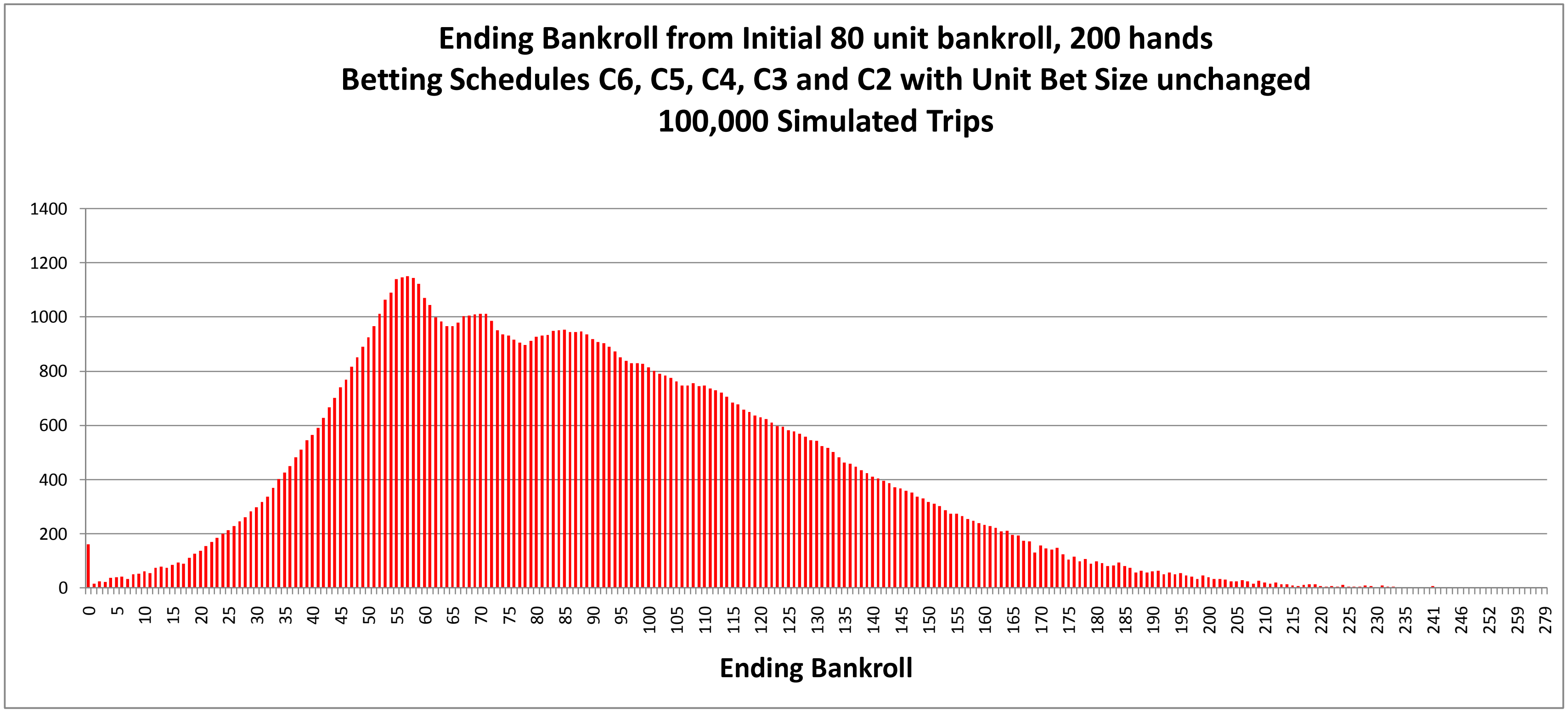
* Excel function "KURT" subtracts "3" so normal distribution has Excel KURT = 0.



Notice that betting schedule C4's risk of ruin of over 2,237 out of 100,000 day trips has been reduced to 169 day trips ruined by switching betting schedules with the size of the current bankroll and the total loss of the bankroll, ending bankroll equal to zero, has been replaced by a high frequency of ending bankroll's around 50 or 60 units which represents 20 or 30 units out of the initial 80 units bankroll lost.



Approximately 45,000 day trips (45%) end in a losing session for the switching betting schedule as opposed to around 40,000 day trips (40%) losing sessions for betting schedule C4. Also for all losses less than 30 units, the switching betting schedule has a higher chance of these losses occurring than betting schedule C4. For losses greater than 30 units, the switching betting schedule has fewer losses than the fixed betting schedule C4. So the switching betting schedule has more small losses (less than 30 units) and fewer large losses (greater than 30 units) than the fixed betting schedule C4.



Initial Bank = 80 units

	Red 7 True Count					
Bet Sch	2	3	4	5	6	>=7
C6	1	2	3	4	5	6
C5	1	2	3	4	5	5
C4	1	2	3	4	4	4
C3	1	2	3	3	3	3
C2	1	2	2	2	2	2

Betting Schedule C6:
(Current Bank) > 100 units

Betting Schedule C5:
90 units < (Current Bank) <= 100 units

Betting Schedule C4:
72 units <= (Current Bank) < 90 units

Betting Schedule C3:
60 units < (Cur Bank) <= 72 units

Betting Schedule C2:
(Current Bank) <= 60 units

100,000 day trip simulation:	
Number of Day Trips ending in bankruptcy	162
Mean	89.3
Standard Deviation	39.1

Skew	0.498
Kurtosis *	-0.059

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting Schedule Comparisons with Betting Schedule C6 added

#0: Switching betting schedules C6, C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 6 units at true counts >= 7 when day trip bankroll > 100 units

#1: Switching betting schedules C5, C4, C3 and C2 based on size of curent bankroll: Increasing the maximum bet to 5 units at true counts >= 6 when day trip bankroll > 90 units

#2: Switching betting schedules C4, C3 and C2 based on size of curent bankroll

#3: Constant 1-4 bet spread, irrespective of size of current bankroll.

#0 has fewer medium size wins and more extreme large wins than #1

100,000 day trip simulation:	#0	#1	#2	#3
Number of Day Trips ending in bankruptcy	162	169	352	2,237
Mean	89.3	89.1	88.6	89.5
Standard Deviation	39.1	38.5	37.1	38.9
Skew	0.498	0.446	0.334	0.007
Kurtosis *	-0.059	-0.132	-0.271	-0.025

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting #0 compared to Betting #1

(1) #0 has a lower risk of ruin

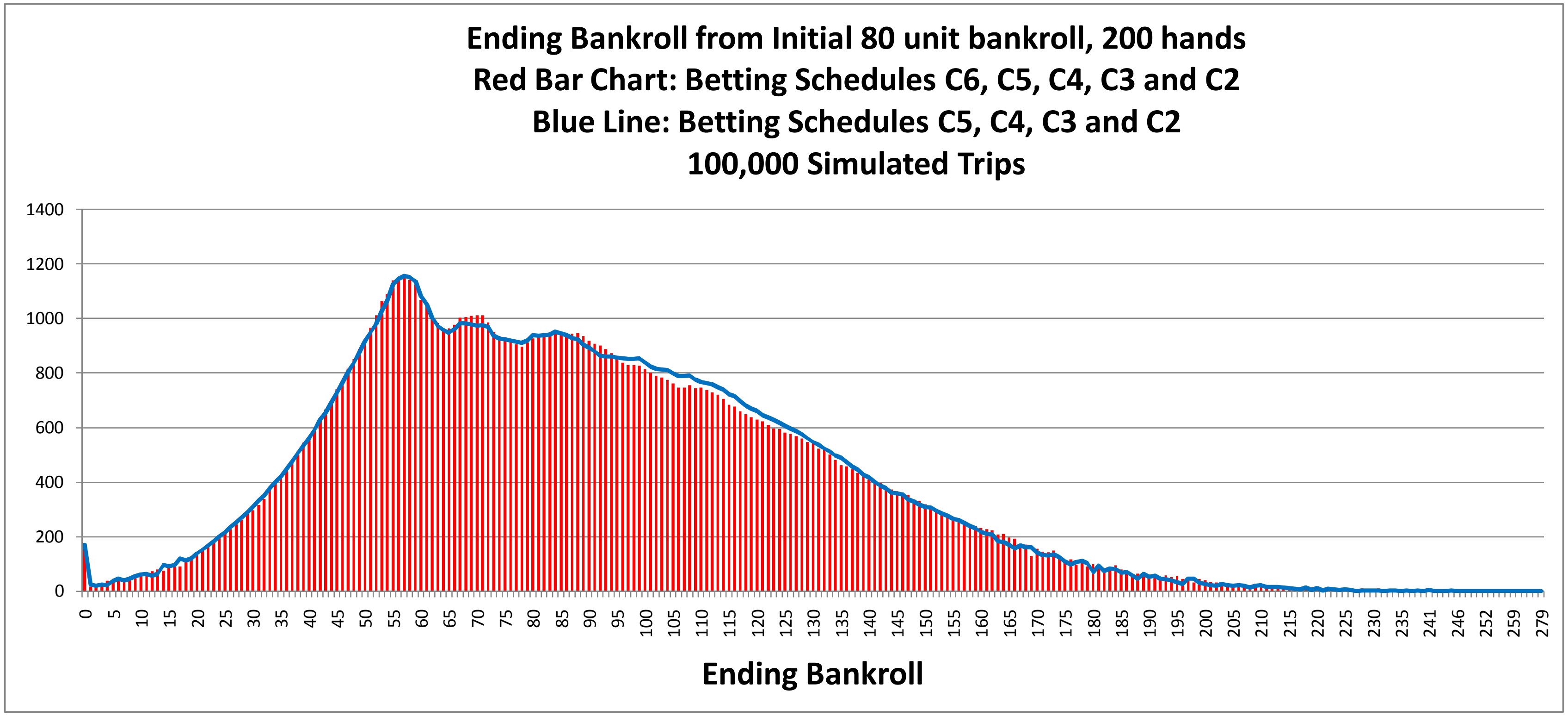
(2) #0 has a higher expected win

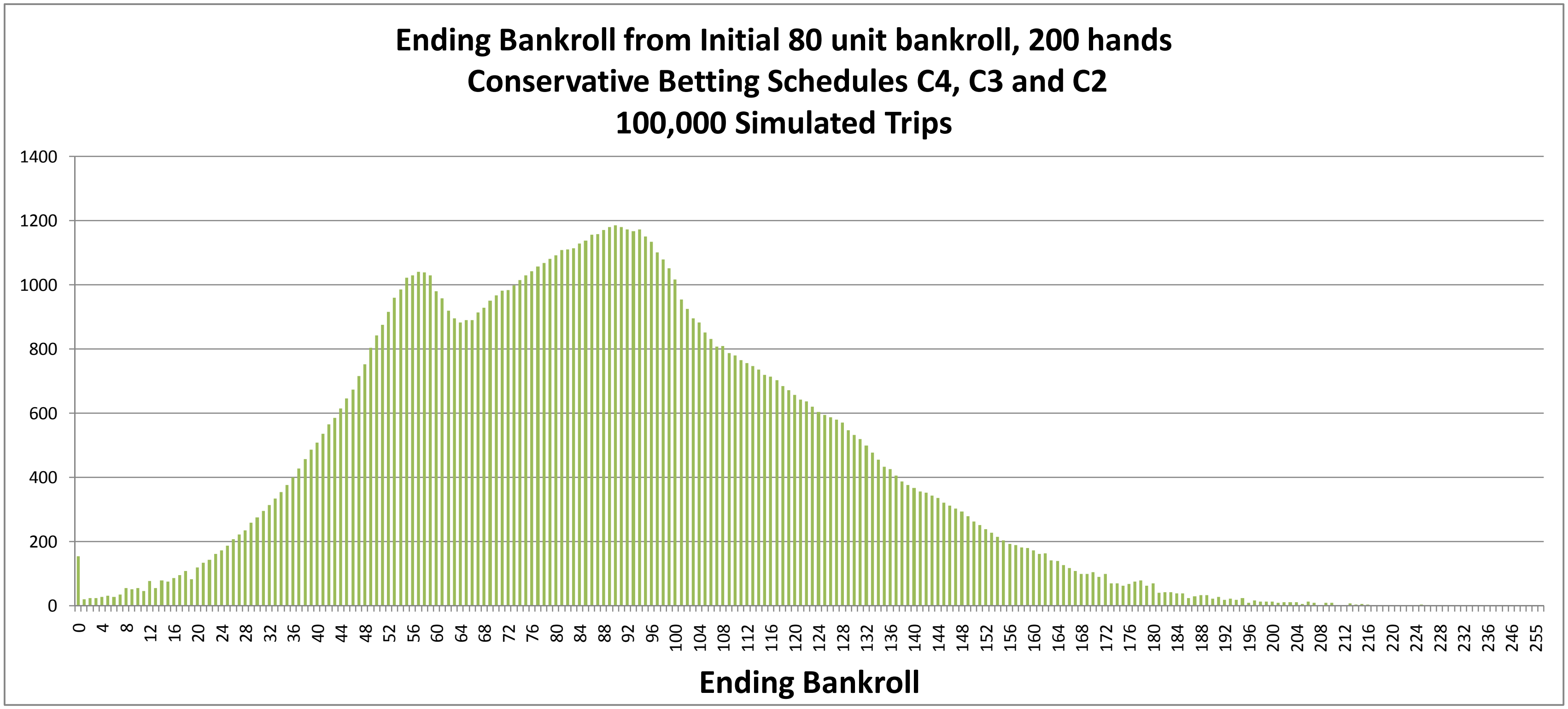
(3) #0 has a slightly higher standard deviation

(4) #0 is more highly skewed to the right (longer right tail):

#0 has less ending bankrolls in the 90 to 140 range but

more ending bankrolls over 150 units.





Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
C4	1	2	3	4
C3	1	2	3	3
C2	1	2	2	2

Betting Schedule C4:
(Current Bank) > 100 units

Betting Schedule C3:
60 units < (Cur Bank) <= 100 units

Betting Schedule C2:
(Current Bank) <= 60 units

100,000 day trip simulation:

Number of Day Trips ending in bankruptcy	154
Mean	88.1
Standard Deviation	35.0

Skew	0.335
Kurtosis *	-0.056

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting Schedule Comparisons Conservative C2-C4 versus Moderate C2-C4

Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
C4	1	2	3	4
C3	1	2	3	3
C2	1	2	2	2

	Conservative	Moderate
Betting Schedule C4:	(Cur Bank) > 100	(Cur Bank) > 72
Betting Schedule C3:	60 < (Cur Bank) <= 100	60 < (Cur Bank) <= 72
Betting Schedule C2:	(Cur Bank) <= 60	(Cur Bank) <= 60

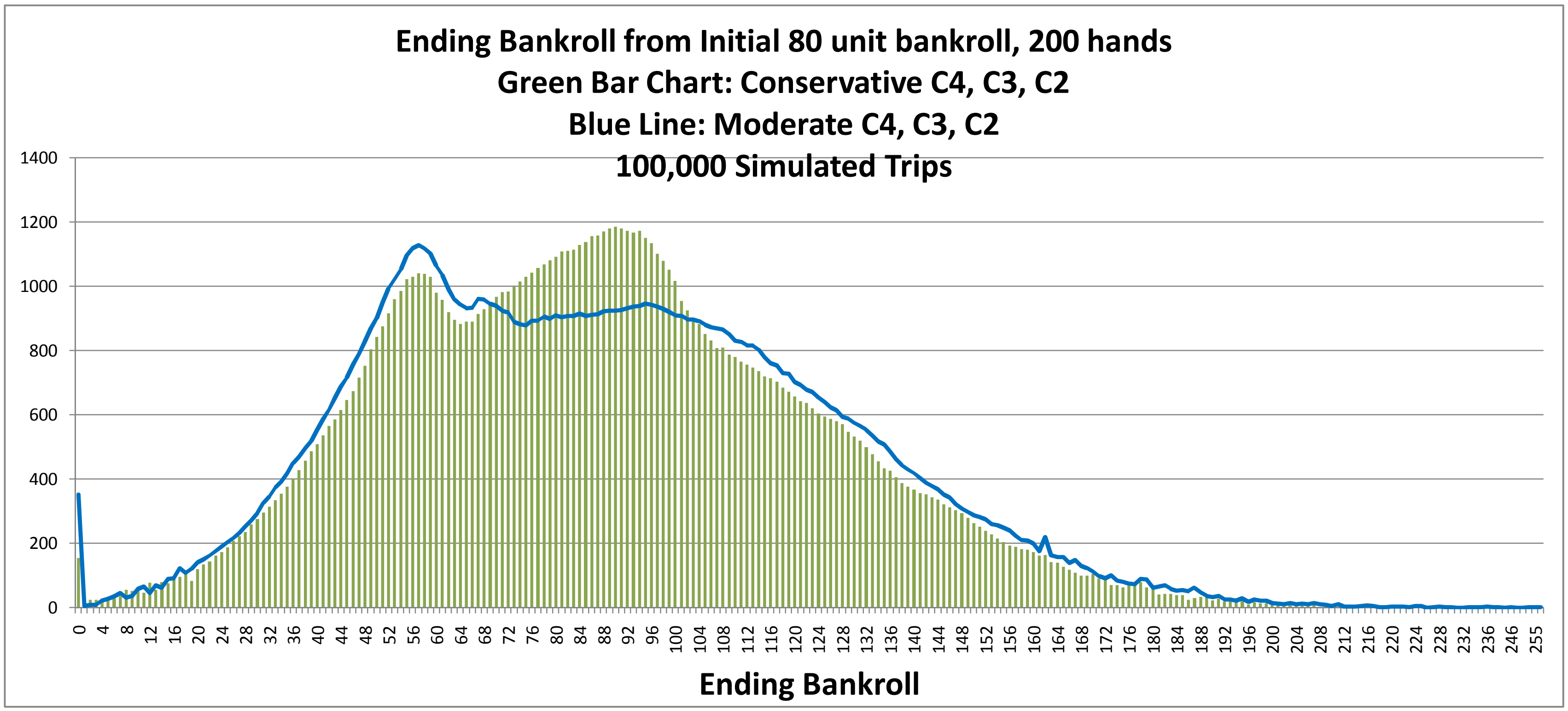
	C2, C3, C4	
100,000 day trip simulation:	Conservative	Moderate
Number of Day Trips ending in bankruptcy	154	352
Mean	88.1	88.6
Standard Deviation	35.0	37.1
Skew	0.335	0.334
Kurtosis *	-0.056	-0.271

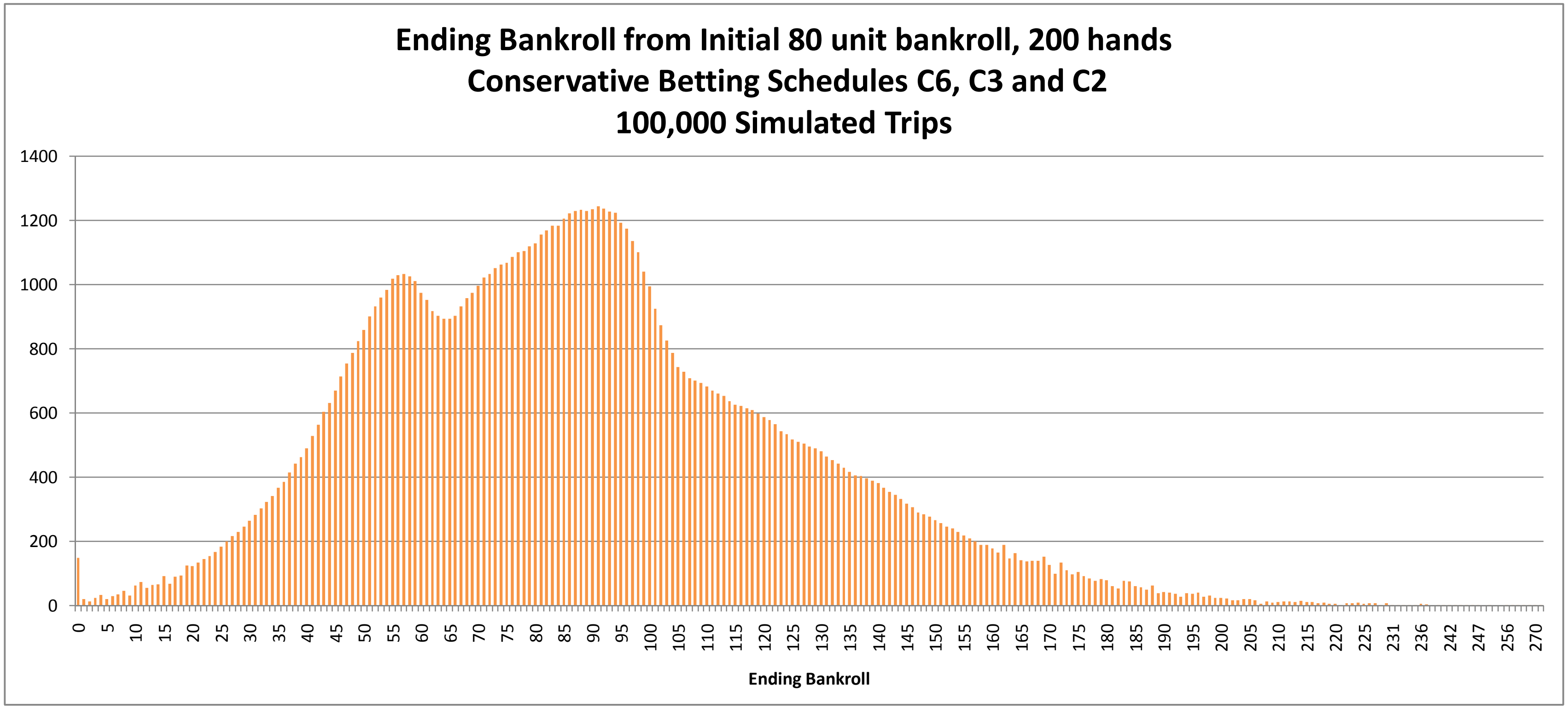
* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative versus Moderate C2-C4

(1) Conservative has a lower risk of ruin
(2) Conservative has slightly lower expected win
(3) Conservative has lower standard deviation
(4) Conservative and Moderate approximately equally skewed to the right.

Mode of conservative C2-C4 is around 88 units which is also the mean ending bankroll, so a profit of the expected win of 8 units is also the most likely occurrence.





Initial Bank = 80 units

	Red 7 True Count					
Bet Sch	2	3	4	5	6	>=7
C6	1	2	3	4	5	6
C3	1	2	3	3	3	3
C2	1	2	2	2	2	2

Betting Schedule C6:
(Current Bank) > 100 units

Betting Schedule C3:
60 < (Current Bank) <= 100 units

Betting Schedule C2:
(Current Bank) <= 60 units

100,000 day trip simulation:	100000
Number of Day Trips ending in bankruptcy	149
Mean	88.4
Standard Deviation	36.2

Skew	0.510
Kurtosis *	0.279

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting Schedule Comparisons Conservative C2-C6 versus Conservative C2-C4

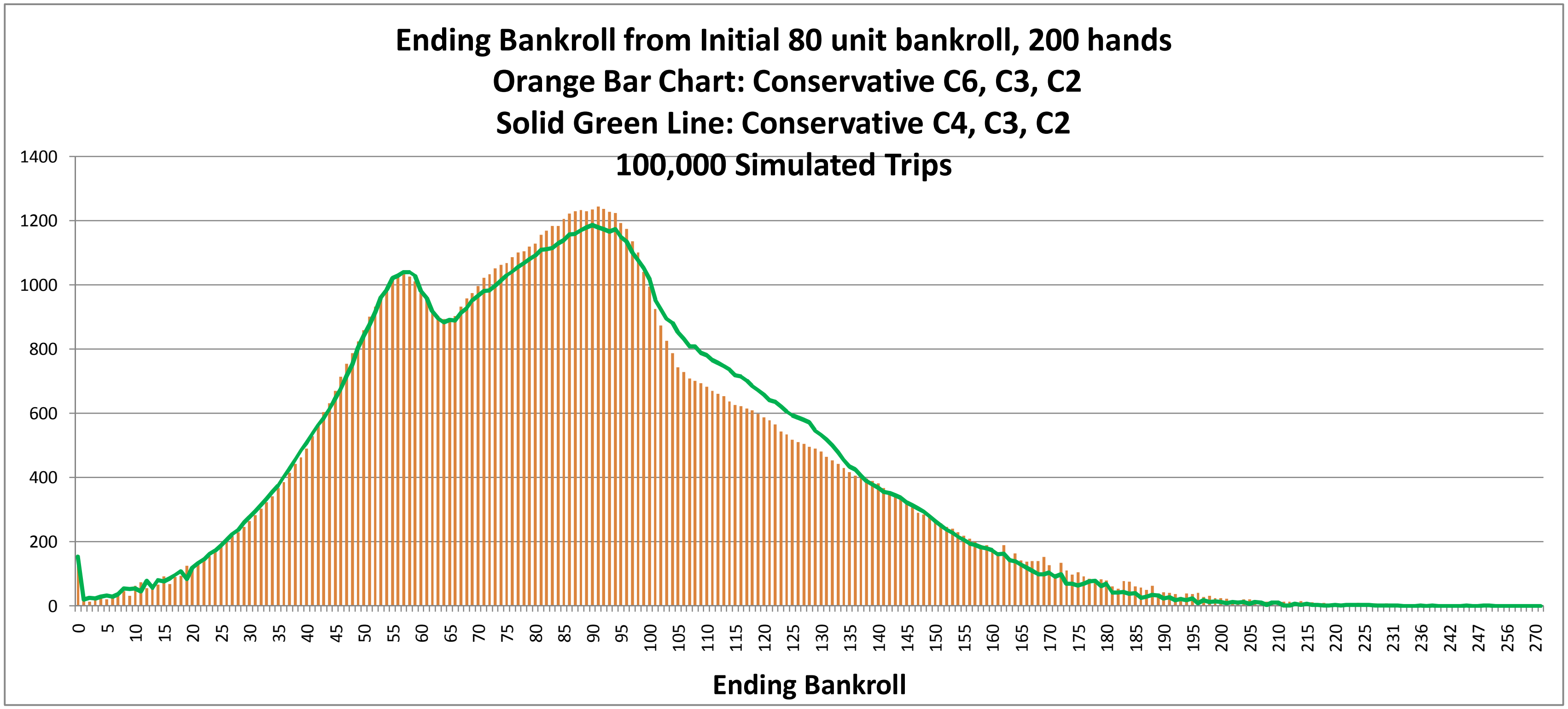
	Conservative C2-C6		Conservative C2-C4
Betting Schedule C6:	(Cur Bank) > 100	Betting Schedule C4:	(Cur Bank) > 100
Betting Schedule C3:	60 < (Cur Bank) <= 100	Betting Schedule C3:	60 < (Cur Bank) <= 100
Betting Schedule C2:	(Cur Bank) <= 60	Betting Schedule C2:	(Cur Bank) <= 60

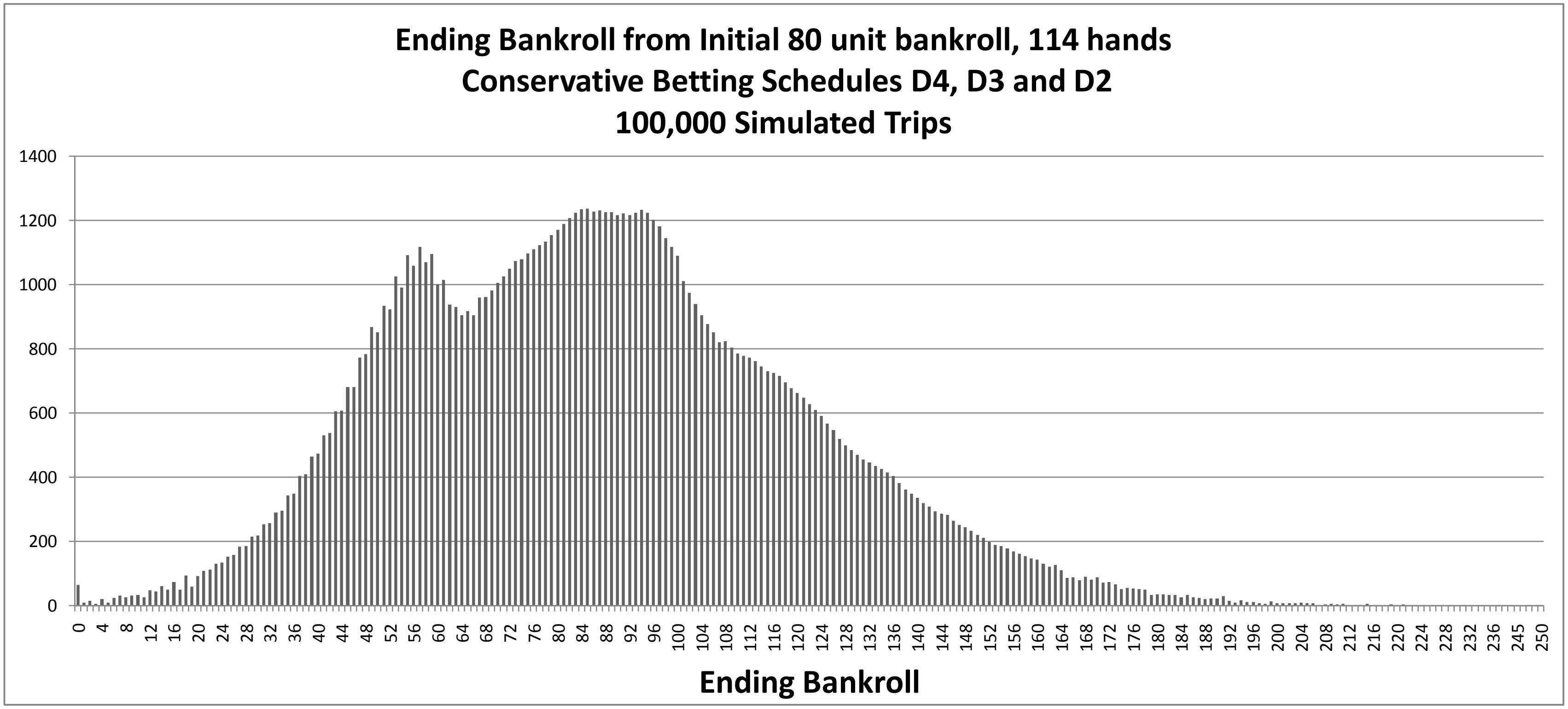
	Conservative	
100,000 day trip simulation:	C2-C6	C2-C4
Number of Day Trips ending in bankruptcy	149	154
Mean	88.4	88.1
Standard Deviation	36.2	35.0
Skew	0.510	0.335
Kurtosis *	0.279	-0.056

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative C2-C6 versus Conservative C2-C4

(1) C2-C6 has slightly lower risk of ruin
(2) C2-C6 has slightly larger expected win
(3) C2-C6 has slightly larger standard deviation
(4) C2-C6 is more highly skewed to the right (longer right tail):
C2-C6 has less ending bankrolls in the 100 to 140 range but
more ending bankrolls between 70 and 100 and over 160 units.





Initial Bank = 80 units

	Red 7 True Count			
Bet Sch	2	3	4	>= 5
D4	0	2	3	4
D3	0	2	3	3
D2	0	2	2	2

Betting Schedule D4:
(Current Bank) > 100 units

Betting Schedule D3:
60 units < (Cur Bank) <= 100 units

Betting Schedule D2:
(Current Bank) <= 60 units

100,000 day trip simulation:

Number of Day Trips ending in bankruptcy	65
Mean	87.3
Standard Deviation	33.0

Skew	0.372
Kurtosis *	0.002

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Betting Schedule Comparisons Conservative D2-D4 versus Conservative C2-C4

Conservative D2-D4
Initial Bank = 80 units

	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
D4	0	2	3	4	B > 100
D3	0	2	3	3	60 < B <= 100
D2	0	2	2	2	B <= 60

Conservative C2-C4
Initial Bank = 80 units

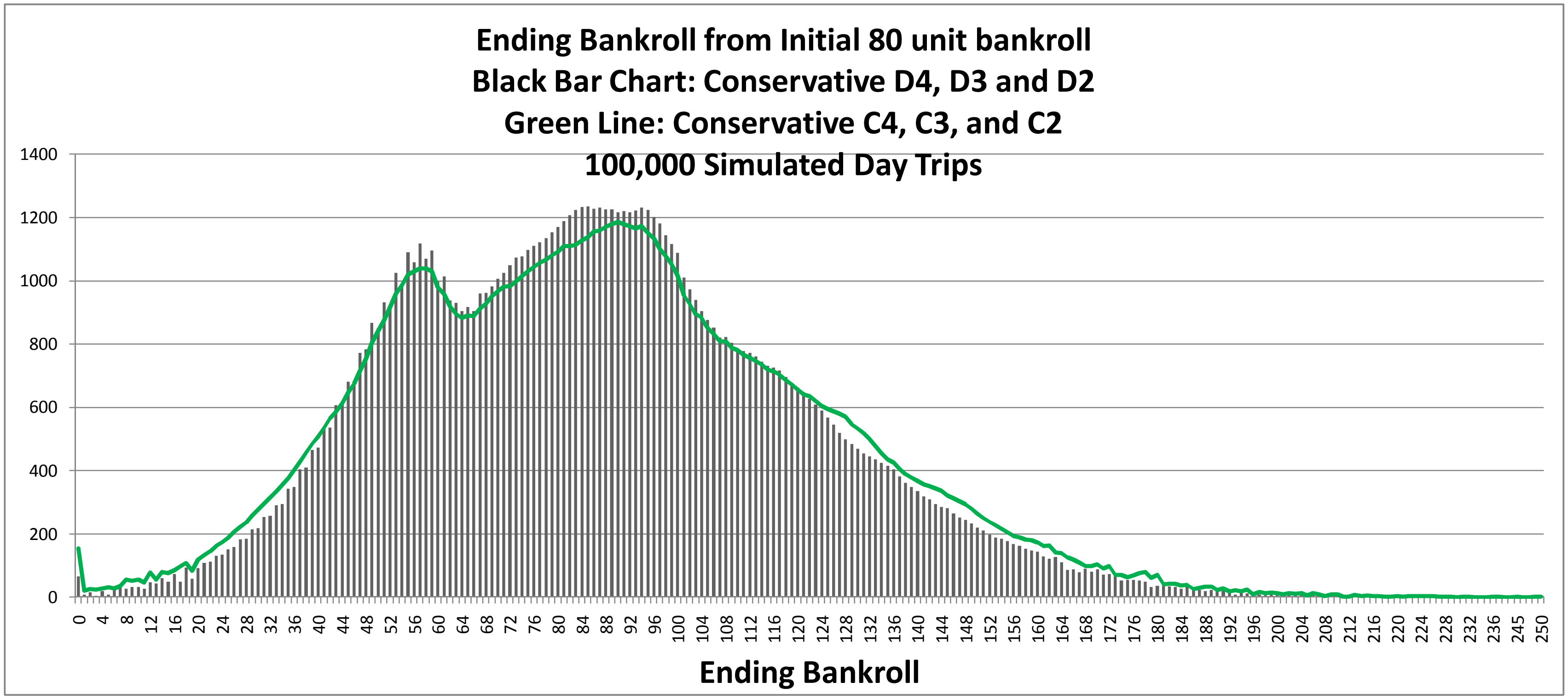
	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
C4	1	2	3	4	B > 100
C3	1	2	3	3	60 < B <= 100
C2	1	2	2	2	B <= 60

	Conservative	
100,000 day trip simulation:	D2-D4	C2-C4
Number of Day Trips ending in bankruptcy	65	154
Mean	87.3	88.1
Standard Deviation	33.0	35.0
Skew	0.372	0.335
Kurtosis *	0.002	-0.056

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative D2-D4 versus Conservative C2-C4

(1) D2-D4 has slightly lower risk of ruin
(2) D2-D4 has slightly lower expected win
(3) D2-D4 has slightly lower standard deviation
(4) D2-D4 approximately equally skewed to the right (long right tail)



Betting Schedule Comparisons Conservative E2-E4 versus Conservative D2-D4

Conservative D2-D4
Initial Bank = 80 units

	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
D4	0	2	3	4	B > 100
D3	0	2	3	3	60 < B <= 100
D2	0	2	2	2	B <= 60

Conservative E2-E4
Initial Bank = 80 units

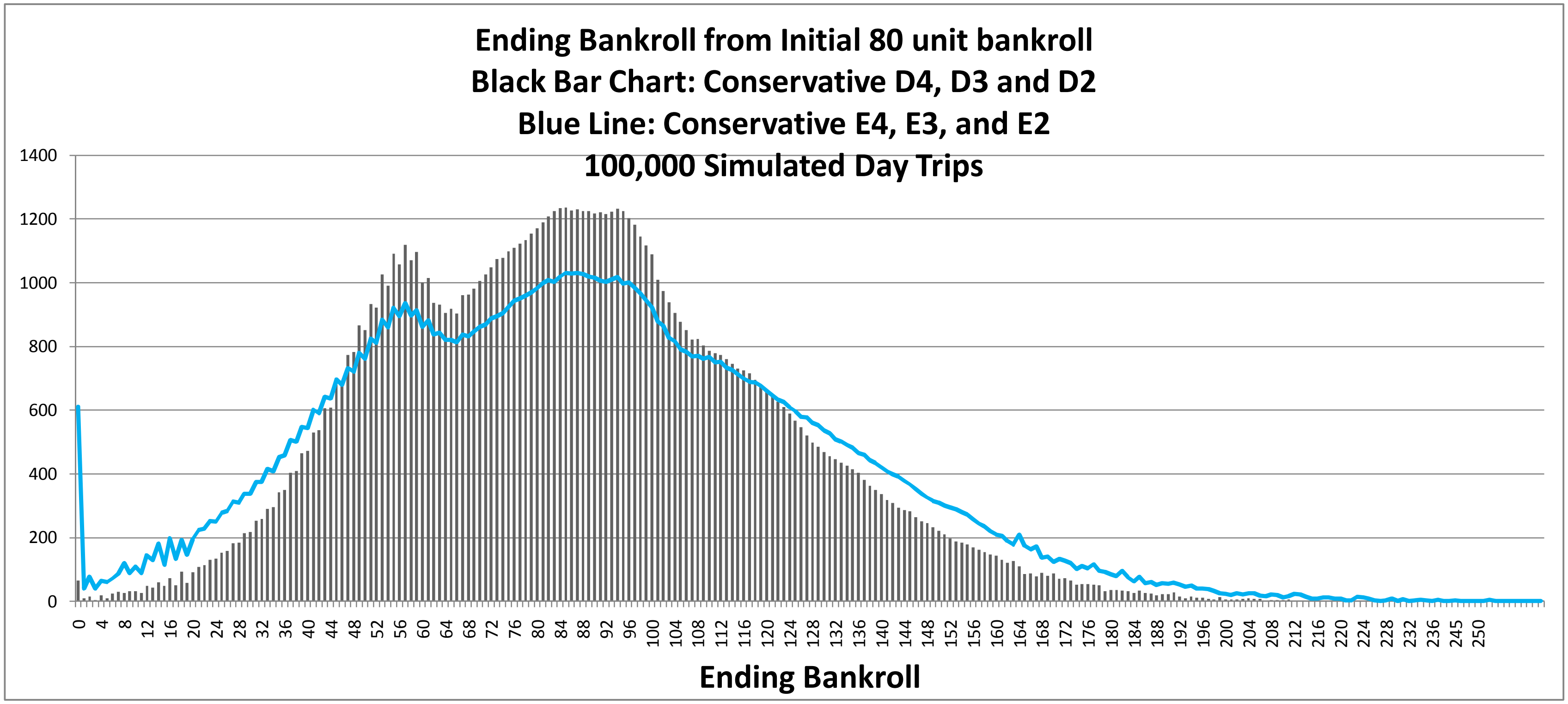
	Red 7 True Count				cur bank
Bet Sch	2	3	4	>= 5	B
E4	2	2	3	4	B > 100
E3	2	2	3	3	60 < B <= 100
E2	2	2	2	2	B <= 60

	Conservative	
100,000 day trip simulation:	D2-D4	E2-E4
Number of Day Trips ending in bankruptcy	65	610
Mean	87.3	88.7
Standard Deviation	33.0	39.7
Skew	0.372	0.297
Kurtosis *	0.002	-0.013

* Excel function "KURT" subtracts "3" so normal disbribution has Excel KURT = 0.

Conservative E2-E4 versus Conservative D2-D4

(1) E2-E4 has higher of risk of ruin
(2) E2-E4 has higher expected win
(3) E2-E4 has higher standard deviation
(4) E2-E4 is more symmetric (less skewed): E2-E4 has less ending bankrolls between 50 and 120 and more ending bankrolls over 120 and less than 40 -- the ending banks < 40 tend to skew E2-E4 to the left reducing its right skew compared to D2-D4.



Calculation of Total Player's Advantage by Red 7 True Count
Infinite Deck Assumption

(from Exhibit F1a, Truing the Red 7 count)

Percentage gain from strategy variation

				*pa(t) = AACpTCp * (t - Idx), t = true count (A)*					Hand Freq
	Sorted by Idx rounded, AACpTCp			True Count					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**

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.

Calculation of Total Player's Advantage by Red 7 True Count
Infinite Deck Assumption
(from Exhibit F1a, Truing the Red 7 count)

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

(from Exhibit F1b, Truing the Red 7 count)

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%**