

# JAILHOUSE POKER

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**M**ATHEMATICAL **A**NALYSIS  
PREPARED FOR **D**AVID **M**OSS.

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**1/15/2009**

*An analysis of the mathematics and statistics inherent to a proposed new casino table game.*

# JAILHOUSE POKER MATHEMATICAL ANALYSIS

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*Prepared by Charles Mousseau, B.Sc. on January 15, 2009.*

Introduction and general procedure:

1. Jailhouse Poker is played with a standard deck of cards.
2. Each player begins by making their initial bet, referred to hereafter as the “Arrest Bet”, and an optional side bet, referred to hereafter as the “Bonus Bet”.
3. The dealer then deals two cards, face down, to each player, and two cards, face down, for himself, followed by three face-down community cards, hereafter referred to as “The Flip”.
4. Each player then decides whether to fold their hand, forfeiting their Arrest Bet, or to continue on by making another bet, hereafter referred to as the “Bail Bet”. The Bail Bet must be at least equal to the amount of the Arrest Bet and no more than double the amount of the Arrest Bet.
  - a. N.B.: If the player makes the Bonus Bet as well as the Arrest Bet, and he chooses to fold his hand, his cards will remain in play for purposes of the Bonus Bet.
5. Once all players have decided on a course of action, the dealer turns each remaining player’s hands face-up, and does one of the following:
  - a. If the dealer’s two-card hand is ahead of the player’s two-card hand (considering only high-card or pair rankings), the dealer moves the player’s Arrest Bet into an *en prison* area (hereafter referred to as the “Court Area”) designated for that player.
  - b. If the dealer’s two-card hand is behind the player’s two-card hand (considering only high-card or pair rankings), the dealer leaves the player’s Arrest Bet in its current position.
  - c. If the player and dealer’s two-card hands are tied, the dealer returns the Arrest Bet to the player. If the player’s two cards are the same suit, the player may choose to leave the Bail Bet in play, in the hopes of beating the dealer with a flush, or he may have it returned to him to end the hand. If the player’s two cards are not suited, the player will have both bets returned to him.
6. The dealer then turns over the three cards of The Flip, which are considered community cards for both the player and the dealer to make their best five-card hands.
7. Finally, the dealer compares his hand to each other player’s hand:
  - a. If the dealer’s hand is higher than the player’s hand (using standard five-card poker rankings), the dealer takes the Arrest Bet (or the bet in that player’s Court Area) and the Bail Bet.
  - b. If the player's hand is higher than the dealer's hand (using standard five-card poker rankings), the player whose two-card hand was behind will be paid the Bail Bet according to the supplied payable and have the Court bet returned; the player whose two-card hand was ahead will be paid the Bail Bet and the Arrest Bet according to the supplied payable, *unless* the winning player hand does not contain a pair, in which case the Bail Bet will push, while the Arrest Bet will be paid even money.
8. If the player finishes with a full house that loses to four-of-a-kind, the player will lose his Arrest Bet and Bail Bet, but will be paid an amount equal to 100 times his Bail Bet, hereafter referred to as the “Bad Beat Bonus”.

9. If the player played the Bonus Bet and has achieved a winning rank, his Bonus Bet is paid irrespective of whether his hand beats the dealer.

Methodologies:

1. A computer program was constructed to iterate through each possible combination of starting player hands and dealer hands, and calculated how often the player won if he decided to play on through the hand along with how likely he was to make each possible five-card hand value.
2. These results were tabulated in a spreadsheet, and manipulation of variables allowed for the determination of a payable that guaranteed the desired house advantage.
3. The figure for the house advantage was verified with a computer simulation of 1,000,000,000 hands.

Results:

1. Assuming the player plays with the optimal strategy, he will fold 9.95% of the time, make the single-sized Bail Bet 55.81% of the time, and make the double-sized Bail Bet 34.24% of the time.
2. Under these assumptions, the house will have an advantage of **4.63% of the initial bet**, or dividing by the total average amount bet, **2.06% of all money wagered** on the “main game”. This latter figure is commonly referred to as the “element of risk”.
3. For the “Bonus Bet”, the house advantage depends on which payable is used. For Paytable A (see Appendix B), the house advantage is **3.89% of the amount wagered**. For Paytable B (see Appendix B), the house advantage is **4.12% of the amount wagered**.

Game security:

1. As the odds in a poker game are very susceptible to the effects of removal of certain cards, it is critical that dealing staff ensure that players do not share information about their hand in any way during the stage of the game where players are deciding whether or not to fold their hand.

Report completed on January 15, 2009 by Charles Mousseau, B.Sc.

*Charles Mousseau*

Results are deemed reliable.

*Appendix A: Pay table for winning Arrest and Bail Bet.*

<u>Hand:</u>	<u>Pays:</u>
NO PAIR	1:1 (on Arrest only)
1 PAIR	1:1
2 PAIR	3:2
TRIPS	2:1
STRAIGHT	4:1
FLUSH	6:1
FULL HOUSE	10:1
QUADS	20:1
STRAIGHT FLUSH	50:1
ROYAL FLUSH	100:1

*Appendix B: Paytable breakdown for the Bonus Bet*

Hand:	# of ways	P(Catch)	Paytable A		Paytable B	
			Return	Value	Return	Value
ROYAL FLUSH	4	0.00000154	500	0.000769539	500	0.000769539
STRAIGHT FLUSH	36	0.00001385	100	0.001385169	100	0.001385169
QUADS	624	0.00024010	40	0.009603842	40	0.009603842
FULL HOUSE	3744	0.00144058	15	0.021608643	12	0.017286915
FLUSH	5108	0.00196540	8	0.015723212	9	0.017688614
STRAIGHT FLUSH	10200	0.00392465	6	0.023547881	6	0.023547881
TRIPS	54912	0.02112845	4	0.084513806	4	0.084513806
2 PAIR	123552	0.04753902	3	0.142617047	3	0.142617047
1 PAIR, 66+	760320	0.29254779	1	0.292547788	1	0.292547788
(losing hands)	1640460	0.63119863	-1	-0.631198633	-1	-0.63119863
<b>Total</b>	<b>2598960</b>	<b>1</b>		<b>-3.89%</b>		<b>-4.12%</b>

Appendix C: Optimal player strategy.

		Suited Cards													Offsuit Cards
		2	3	4	5	6	7	8	9	T	J	Q	K	A	
2	D	F	F	F	F	S	S	S	S	S	S	S	S	D	
3	F	D	F	F	S	S	S	S	S	S	S	S	D	D	
4	F	F	D	S	S	S	S	S	S	S	S	S	D	D	
5	F	F	F	D	S	S	S	S	S	S	S	S	D	D	
6	F	F	S	S	D	S	S	S	S	S	S	S	D	D	
7	F	S	S	S	S	D	S	S	S	S	S	S	D	D	
8	S	S	S	S	S	S	D	S	S	S	S	D	D	D	
9	S	S	S	S	S	S	S	D	S	S	D	D	D	D	
T	S	S	S	S	S	S	S	S	D	D	D	D	D	D	
J	S	S	S	S	S	S	S	S	S	D	D	D	D	D	
Q	S	S	S	S	S	S	S	D	D	D	D	D	D	D	
K	S	S	S	S	D	D	D	D	D	D	D	D	D	D	
A	D	D	D	D	D	D	D	D	D	D	D	D	D	D	

F: Fold Hand.

S: Single-sized Bail Bet.

D: Double-sized Bail Bet.

To find the optimal strategy:

If the hand is suited, look across for the higher card, then down for the lower card.

If the hand is offsuit, look down for the higher card, then across for the lower card.