Mathematical Analysis
OF
Quick Draw Hold'em

Prepared
For

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Quick Draw Hold'em is a new table game similar to Hold'em Poker. It is played with one standard deck of cards. The player does not compete against the dealer.

Rules of Play

Quick Draw Hold'em offers a primary wager and two separate optional bonus side bets. The first bonus side bet is the 3 Card Flop Bonus; the second bonus side bet is based on the Best 4 out of 5 Community Cards. Players win according to pay tables for each of the Bonus side bets. Bonuses will be paid on the highest hand only.

To start the game, players must place a primary wager in the circle marked Flop. The optional Bonus bets must also be placed at the start of each game. The dealer beginning from their left will deal each player who has made the Flop bet two cards face down. The dealer will then place five community cards in the appropriate spots on the table.

The dealer will reveal the first three community cards (known as the flop). Non-winning 3 Card Flop Bonus bets will be collected by the dealer. Winning 3 Card Flop Bonus Bets will be paid by the dealer according to the 3 Card Flop Bonus pay tables below:

Hand Type	B1	B2	B3
Straight Flush	40	40	40
3 of a Kind	30	25	30
Straight	6	6	6
Flush	4	4	3
One Pair	1	1	1

All payouts are "to 1."

After players view their two cards and the first three Community cards, they have the option to either fold or place an additional wager equal to the Flop wager in the circle marked Turn. The dealer will then reveal the 4th community card (known as the Turn Card). Players who fold will lose their Flop bet and the dealer will collect all the Flop bets of all those players who have elected to fold.

After players view the Turn card, they have an option to either fold or place an additional wager equal to the Turn wager in the circle marked River Bonus. Players who fold will lose their wagers placed on both the Flop bet and Turn bet and the dealer will collect wagers from each player who has folded their hand. The dealer will then reveal the 5th and final community card (known as the River card).

Players who have made the River Bonus Bet will have their 2 card hand combined with the 5 community cards. Players who achieve a winning hand using the best 5 out of 7 cards will be paid on all three of the following betting spots as follows:

- Flop Bet even money
- Turn Bet even money
- River Bonus Bet will be paid according to the River Bonus pay table. The pay tables are shown below:

Hand	A1	A2	A3
Royal Flush	250	250	200
Straight Flush	50	50	50
4 of a Kind	20	15	25
Full House	5	5	5
Flush	4	4	4
Straight	3	3	3
3 of a Kind	2	2	2
7s-High 2 Pair (e.g., 7,7,4,4; J,J,2,2 but not 6,6,3,3)	1	1	1

All payouts are "to 1."

Players who do not have a 7 card hand that is 7s-high two pair or better will have all their 3 wagers collected by the dealer.

Players who have placed a bonus bet on the Best 4 out of 5 Community Cards are still eligible to receive their bonus even if they elect to fold during the core game. There are four-card straights, flushes and straight flushes but there will be no full houses. The pay tables are as follows:

Hand Type	C1	C2	C3	C4	C5	C6
Royal Flush	500	500	400	250	250	250
4 of a Kind	100	100	80	100	100	100
Straight Flush	50	30	25	40	30	50
3 of a kind	5	5	5	6	6	5
Flush	3	3	3	3	3	3
Straight	3	3	3	3	3	3
Two Pair	2	2	2	2	2	2
A Pair of Jacks O/B	1	1	1	1	1	1

All payouts are "to 1."

Mathematical Analysis

There are $C_{52,5}$ x $C_{47,1}$ x $C_{46,1}$ = 2,598,960 x 47 x 46 = 56,189,515,200 ways to deal five cards from a 52-card deck, one card from the remaining 47-card deck and then one card from the remaining 46-card deck. A computer program known as a combinatorial analyzer was developed to evaluate all of the hands in order to determine the optimal strategies and the player expectation. The algorithm for the analysis is described below.

First of all, an interim pay table is devised. Then the analyzer cycles through all 134,459 distinct 5-card hands[1]. It calculates the return for each of the 5-card hands by considering all possible 1081 2-card combinations of the remaining 47 cards, and notes down the return for each of 47 6-card hands. (Although each of the 1081 2-card combinations from the 47-card deck can be dealt in two ways, the return for the entire 7-card hand remains the same regardless of the order of the 2 cards. So, it's unnecessary to calculate the return twice. However, the order is only considered when determining the strategy and return for the 6-card hands.) The return is calculated under the assumption that the player has not folded. If the return for a 6-card hand is less than -2, the 6-card hand should be folded. If the return for a 5-card hand is less than -1, the 5-card hand should be folded. The play (to press it up or fold) that results in the better return is selected for every hand being evaluated.

Once the strategy for the 5-card hands has been determined, the player's overall expectation is derived. Depending on whether the expectation is acceptable, the interim pay table is tweaked and the same process is repeated until the player expectation derived is satisfactory.

The 5-card hand optimal strategy for pay table A3 is given in Appendix A.

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[1] There are 2598960 5-card hands but only 134459 of them are distinct. Also, it doesn't matter which two of the five cads are in the player's hand because there is no dealer hand.

Pay Table A1

Final Hand Probability Distribution and Expectations

Hand	% 2 Bets	% 3 Bets	Pays	% Probability	% Return
Royal Flush	0	0.002925	250	0.002925	0.7370
Straight Flush	0	0.025444	50	0.025444	1.3231
4 of a Kind	0	0.166641	20	0.166641	3.6661
Full House	0	2.557596	5	2.557596	17.9032
Flush	0	2.450435	4	2.450435	14.7026
Straight	0.241582	3.204102	3	3.445684	15.5373
3 of a Kind	0	4.199194	2	4.199194	16.7968
7s-High 2 Pair	0	17.676716	1	17.676716	53.0301
Nothing	2.536616	27.346451	-1	29.883067	-87.1126
Fold 1st Bet	0	0	-1	39.592298	-39.5923
Total	2.778198	57.629504		100.000000	-3.0086

The hit frequency is 30.2831%. The player's average bet will be 2.1804 bets. The house advantage is 3.0086% of the ante or 3.0086% / 2.1804 = 1.3799% per total wager.

Pay Table A2

Final Hand Probability Distribution and Expectations

Hand	% 2 Bets	% 3 Bets	Pays	% Probability	% Return
Royal Flush	0	0.002925	250	0.002925	0.7370
Straight Flush	0	0.025444	50	0.025444	1.3231
4 of a Kind	0	0.166641	15	0.166641	2.8329
Full House	0	2.557596	5	2.557596	17.9032
Flush	0	2.450435	4	2.450435	14.7026
Straight	0.241582	3.204102	3	3.445684	15.5373
3 of a Kind	0	4.199194	2	4.199194	16.7968
7s-High 2 Pair	0	17.676716	1	17.676716	53.0301
Nothing	2.536616	27.346451	-1	29.883067	-87.1126
Fold 1st Bet	0	0	-1	39.592298	-39.5923
Total	2.778198	57.629504		100.000000	-3.8419

The hit frequency is 30.2831%. The player's average bet will be 2.1804 bets. The house advantage is 3.8419% of the ante or 3.8419% / 2.1804 = 1.7620% per total wager.

Pay Table A3

Final Hand Probability Distribution and Expectations

Hand	% 2 Bets	% 3 Bets	Pays	% Probability	% Return
Royal Flush	0	0.002925	200	0.002925	0.5908
Straight Flush	0	0.025444	50	0.025444	1.3231
4 of a Kind	0	0.166641	25	0.166641	4.4993
Full House	0	2.557596	5	2.557596	17.9032
Flush	0	2.450435	4	2.450435	14.7026
Straight	0.241582	3.204102	3	3.445684	15.5373
3 of a Kind	0	4.199194	2	4.199194	16.7968
7s-High 2 Pair	0	17.676716	1	17.676716	53.0301
Nothing	2.536616	27.346451	-1	29.883067	-87.1126
Fold 1st Bet	0	0	-1	39.592298	-39.5923
Total	2.778198	57.629504		100.000000	-2.3217

The hit frequency is 30.2831%. The player's average bet will be 2.1804 bets. The house advantage is 2.3217% of the ante or 2.3217% / 2.1804 = 1.0648% per total wager.

3 Card Flop Bonus Side Bet

Pay Table B1

Hand Type	% Probability	Pays	% Return
Straight Flush	0.2172	40	8.6878
3 of a Kind	0.2353	30	7.0588
Straight	3.2579	6	19.5475
Flush	4.9593	4	19.8371
One Pair	16.9412	1	16.9412
Nothing	74.3891	-1	-74.3891
Total	100.0000		-2.3167

Pay Table B2

Hand Type	% Probability	Pays	% Return
Straight Flush	0.2172	40	8.6878
3 of a Kind	0.2353	25	5.8824
Straight	3.2579	6	19.5475
Flush	4.9593	4	19.8371
One Pair	16.9412	1	16.9412
Nothing	74.3891	-1	-74.3891
Total	100.0000		-3.4932

Pay Table B3

Hand Type	% Probability	Pays	% Return
Straight Flush	0.2172	40	8.6878
3 of a Kind	0.2353	30	7.0588
Straight	3.2579	6	19.5475
Flush	4.9593	3	14.8779
One Pair	16.9412	1	16.9412
Nothing	74.3891	-1	-74.3891
Total	100.0000		-7.2760

The hit frequency for all three pay tables is 25.6109%.

Best 4 Out Of 5 Community Cards Side Bet

Pay Table C1

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	500	3.6938
4 of a Kind	0.024010	100	2.4010
Straight Flush	0.072337	50	3.6168
3 of a kind	2.256903	5	11.2845
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000		-4.1955

Pay Table C2

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	500	3.6938
4 of a Kind	0.024010	100	2.4010
Straight Flush	0.072337	30	2.1701
3 of a kind	2.256903	5	11.2845
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000	-	-5.6423

Pay Table C3

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	400	2.9550
4 of a Kind	0.024010	80	1.9208
Straight Flush	0.072337	25	1.8084
3 of a kind	2.256903	5	11.2845
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000		-7.2229

Best 4 out of 5 Community Cards Side Bet
Pay Table C4

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	250	1.8469
4 of a Kind	0.024010	100	2.4010
Straight Flush	0.072337	40	2.8935
3 of a kind	2.256903	6	13.5414
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000		-4.5089

Pay Table C5

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	250	1.8469
4 of a Kind	0.024010	100	2.4010
Straight Flush	0.072337	30	2.1701
3 of a kind	2.256903	6	13.5414
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000		-5.2322

Pay Table C6

Hand Type	% Probability	Pays	% Return
Royal Flush	0.007388	250	1.8469
4 of a Kind	0.024010	100	2.4010
Straight Flush	0.072337	50	3.6168
3 of a kind	2.256903	5	11.2845
Flush	4.410072	3	13.2302
Straight	3.917259	3	11.7518
Two Pair	4.753902	2	9.5078
A Pair of Jacks O/B	12.438360	1	12.4384
Nothing	72.119771	-1	-72.1198
Total	100.000000		-6.0424

The hit frequency for the above six pay tables is 27.8802%.