Mathematical Analysis

Jackpot 16 - Player versus Dealer.

Charles R. Mousseau
351 Beliveau Road
Winnipeg, MB, R2M 1S8, Canada
Phone: (204) 509 4644
E-mail: charles@tgscience.com
Web: http://www.tgscience.com

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Introduction & General Procedure

1. This report deals with the game Jackpot 16 and, specifically, when one or more players are playing by "player versus dealer" rules.
2. Jackpot 16 can be played with either 6 or 8 decks of cards that have the nines, tens, and face cards removed.
3. In Jackpot 16, aces count as one and all other cards count as their pip value.
4. Play begins with each player making the main wager.
5. Each player will receive two cards, face-up, and the dealer will receive two cards, one face-up and one face-down.
6. If a player's hand is a natural sixteen (that is, a two card pair of eights), they win automatically UNLESS the dealer also has a two card pair of eights, in which case they play
7. Each remaining player may stand pat or draw cards in turn until:
    a. The player gets a total greater than 16, in which case they bust and lose automatically.
    b. The player is satisfied with their total.
    c. The player has a total of four cards, at which point they must stand.
8. Once all players have played, if any players have not busted, the dealer reveals their second card and resolves their hand as follows:
    a. If they have a natural sixteen (that is, a two card pair of eights), the dealer wins and beats any player total, including any three or four card total of sixteen.
    b. If they have a total of 13 or higher, the dealer stands pat

   c. Otherwise, they draw cards until they either get a total of 13 or greater, or have a four card hand, in which case they stand.

9. If neither player nor dealer have busted, the highest total wins, with ties pushing.

Methodologies

A computer program was written in C++ to perform an exact calculation of the player return from the start of a freshly shuffled six deck shoe, by calculating the expected value of each starting hand against each starting dealer upcard. At each possible decision, the expectations for both hitting and standing decisions were calculated, with the higher scoring decision being selected as the optimal player strategy.

These calculations were then repeated for an eight deck shoe.

Finally, a total-dependent "basic strategy" was determined by examining the calculated decision choices, and this strategy was used to power two simulations of one billion rounds, one with a six deck shoe and one with an eight deck shoe, both with a cut card placed at the 26-card mark.

Results

With optimal play by the player, the house edge off the top of a freshly shuffled shoe was calculated as follows:

* 6 decks: 4.39%
* 8 decks: 4.40%

Note that, because each individual player's action have no effect on the likelihood of other players winning, the house edge applies to each player irrespective of how many players started the round, or played in prior rounds.

The total-dependent "basic strategy" was calculated as follows:

* When the dealer is showing an ace, 2, 3, or 4, the player stands on a total of 12 or more.
* When the dealer is showing a 5, 6, 7, or 8, the player stands on a total of 13 or more.

Based on this strategy, the one billion round simulations yielded the following house edges:

* 6 decks: 4.38%
* 8 decks: 4.39%

A full breakdown of the simulation results can be found in the attached spreadsheet.

Results are deemed reliable.

Appendix

Six deck simulation.

Event	#(Event)	P(Event)	Odds (1-in)	Payout	Value
Win - natural 88	14,786,689	0.014787	67.6	1	0.014787
Win - other	406,894,135	0.406894	2.5	1	0.406894
Push	112,804,577	0.112805	8.9	0	0.000000
Lose to dealer 88	14,780,811	0.014781	67.7	-1	-0.014781
Lose, player busts	172,165,407	0.172165	5.8	-1	-0.172165
Lose, other	278,568,381	0.278568	3.6	-1	-0.278568
Totals:	**1,000,000,000**	**1.000000**		**Return:**	**-0.043834**

Eight deck simulation.

Event	#(Event)	P(Event)	Odds (1-in)	Payout	Value
Win - natural 88	14,928,275	0.014928	67.0	1	0.014928
Win - other	406,750,514	0.406751	2.5	1	0.406751
Push	112,748,531	0.112749	8.9	0	0.000000
Lose to dealer 88	14,934,651	0.014935	67.0	-1	-0.014935
Lose, player busts	172,106,135	0.172106	5.8	-1	-0.172106
Lose, other	278,531,894	0.278532	3.6	-1	-0.278532
Totals:	**1,000,000,000**	**1.000000**		**Return:**	**-0.043894**