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Scenario and settings:

Our scenario is based on a home party scenario, some of our friends and us are playing blackjack in the party, and the chips in the party is beer instead of money. If winning one round of game, the winner can ask the loser to drink one cup of beer.

Apart from the basic rules and options(hit, stand, split), we set the return values as below:

Player wins: 1

Dealer wins: -1

Tie: 0

Player can and only can split one time at most. If split, the value is the sum of the return values of two hands. We didn't set a different value for a natural blackjack case.

Stimulation results and analysis:

We run 1,000,000 times for each standpoint and calculated the expectation values. Then we transform the best standpoint to strategy decisions based on player's current hand and dealer's one card that is showing.

The strategies are shown as below, which is slightly different than our reference strategies on the 'edges'(marked red). We believe it has something to do with our limits of options, but for the overall strategy we believe we did the stimulation right. The smulation data are contained in Excel along side with this analysis.

Specially, for the cases where the player's hand can be split(aka two cards are the same), we compare the expectations when we set whether split is allowed differently. Expectation values are transformed based on rules that: When expectation is higher than 1, no need to check if should split (marked green). When split expectation is higher than no split expectation, split. Else hit or stand based on comparison with player hand and standpoint.

In this case we believe we are running a true monte carlo simulation since we exhaust all options possible and didn't input any prior that might affect the results(ike setting a fixed dealer's hand).

| Player Hand/D ealer Show | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A |
|-----------------------------------|---|---|---|---|---|---|---|---|----|---|
| 5-11 | H | H | H | H | H | H | H | H | H | H |
| 12 | H | H | H | S | S | H | H | H | H | H |
| 13 | H | S | S | S | S | H | H | H | H | H |
| 14 | S | S | S | S | S | H | H | H | H | H |
| 15 | S | S | S | S | S | H | H | H | H | H |

| | | | | | | | | | | |
|-------|---|---|---|---|---|---|---|---|---|---|
| 16 | S | S | S | S | S | H | H | H | H | H |
| 17 | S | S | S | S | S | S | S | S | S | H |
| 18-21 | S | S | S | S | S | S | S | S | S | S |

*2 same cards cases not included

| Player's hand/ Dealer Show | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A |
|-------------------------------|------|------|------|------|------|------|------|------|------|------|
| A,A | P | P | P | P | P | P | P | P | P | P |
| 2,2 | P | P | P | P | P | P | P | P | P | P |
| 3,3 | P | P | P | P | P | P | P | P | P | P |
| 4,4 | P | P | P | P | P | P | P | P | P | P |
| 5,5 | H/15 | H/14 | H/12 | H/12 | H/14 | H/17 | H/14 | H/16 | H/16 | H/14 |
| 6,6 | P | P | P | P | P | P | P | P | P | H/14 |
| 7,7 | P | P | P | P | P | P | P | P | P | H/16 |
| 8,8 | P | P | P | P | P | P | P | P | P | P |
| 9,9 | P | P | P | P | P | P | P | P | P | P |
| 10,10 | S | S | P | S | P | P | S | S | S | S |

Reference:

<https://wizardofodds.com/games/blackjack/strategy/4-decks/>