

## Mathematics of Card Games Appendix

### Probability of Cribbage Scores

Score	Probability
0	0.0788
1	0.007801
2	0.2188
3	0.03929
4	0.2212
5	0.05419
6	0.1375
7	0.05803
8	0.08604
9	0.02719
10	0.02887
11	0.003241
12	0.02374
13	0.001172
14	0.006729
15	0.00066
16	0.004407
17	0.0008613
18	0.000173
19	0
20	0.0006024
21	0.0001902
22	0.00003417
23	0.0000274
24	0.0002832
25	0
26	0
27	0
28	0.00000585
29	0.000000308

### Blackjack Odds of Busting

Hand Value	% Bust if you Hit
21	100%
20	92%
19	85%
18	77%
17	69%
16	62%
15	58%
14	56%
13	39%
12	31%
11 or less	0%

## **“Basic” Blackjack Strategy**

Hard Hands: Starting hand does not contain an Ace

- If you have eight or less, always hit.
- If you have Nine: Double if the dealer has 3 thru 6 - otherwise hit.
- If you have Ten : Double if the dealer has 2 thru 9 - otherwise hit.
- If you have Eleven: Double if the dealer has 2 thru 10, Hit if dealer has Ace.
- If you have Twelve: Hit if the dealer has 2 or 3, Stand if the dealer has 4 thru 6, otherwise hit.
- If you have 13- 16: Stand if the dealer has 2 thru 6, otherwise hit.
- If you have 17 - 21: Always Stand.

Soft Hands: Starting hand contains an Ace

- If you have Ace 2 or Ace 3: Double if the dealer has 5 or 6 - otherwise hit.
- If you have Ace 4 or Ace 5: Double if the dealer has 4 thru 6 - otherwise hit.
- If you have Ace 6: Double if the dealer has 3 thru 6 - otherwise hit.
- If you have Ace 7: Stand if the dealer has 2, 7 or 8. Double 3 -thru 6 - otherwise hit.
- If you have Ace 8 or Ace 9: Always Stand.

Pairs: Starting hand contains a pair

- If you have a pair of Aces or Eights: Always split.
- If you have a pair of twos or threes: Split if the dealer has 2 - 7, otherwise hit.
- If you have a pair of fours: Split if the dealer has 5 or 6 - otherwise hit.
- If you have a pair of fives: Double if the dealer has 2 thru 9 - otherwise hit.
- If you have a pair of sixes: Split if the dealer has 2 thru 6 - otherwise hit.
- If you have a pair of sevens: Split 2 thru 7 - otherwise hit.
- If you have a pair of nines: Split 2 thru 6, and 8 or 9. Stand if the dealer has 7, 10 or Ace.
- If you have a pair of tens: Always Stand.

Card Game Rules

Cribbage Gameplay

1. **The Deal:** The players cut for first deal, and the dealer shuffles and deals five or six cards to each player, depending on the number of players. For two players, each is dealt six cards; for three or four players, each is dealt five cards. In the case of three players, a single card is dealt face down in the centre of the table to start the crib. Once the cards have been dealt, each player chooses four cards to retain, then discards the other one or two face-down to form the "crib" which will be used later by the dealer. At this point, each player's hand and the crib will contain exactly four cards. The player on the dealer's left cuts the deck and the

dealer reveals the top card, called the "starter". If this card is a Jack, the dealer scores two points for "his nibs."

2. **The Play:** Starting with the player on the dealer's left, each player lays one card in turn onto a personal discard pile, stating the cumulative value of the cards laid (for example, the first player lays a five and says "five", the next lays a six and says "eleven", and so on), without the total going above 31. Once no more cards can be played, the cumulative position is reset to zero and those players with cards remaining repeat the process until all players' cards have been played. Players score points during this process for making a total of fifteen, for reaching exactly, or as close as possible to a total of thirty-one, for runs and for pairs.
3. **The Show:** Once the play is complete, each player in turn receives points based on the content of his hand *in conjunction with the starter card*. Points are scored for combinations of cards totaling fifteen, runs, pairs, flushes and having nibs. The dealer scores his hand last and then turns the cards in the crib face up. These cards are then scored by the dealer as an additional hand in conjunction with the starter card. Scores between 0 and 29 are all possible, with the exception of 19, 25, 26 and 27.

### Blackjack Gameplay

Before each round of play, the player places his bet. Each player and the dealer initially receive two cards; only one of the dealer's cards is shown to the player. A card's value is equal to its rank, but picture cards are worth 10; an ace is worth either 1 or 11. For simplicity, refer to all 10-valued cards as 10. The player has several options, depending on his cards. He may:

- **Hit:** Draw another card. A player is allowed to hit any hand not exceeding 21. If the player's card total exceeds 21, he has 'busted,' and automatically loses his bet.
- **Stand:** Draw no more cards.
- **Double down:** Double the original bet and receive one card only. This option is allowed on a two-card hand only.
- **Split:** If the player has two cards of equal value, he may place another bet equal to his original one, and play each card as a separate hand. Exceptions: if the player splits two aces, he receives only one card on each; an (A 10) counts as 21, not blackjack; and even if resplitting is allowed otherwise, the player may not resplit aces.

### Five-Card Draw Poker Gameplay

1. Big/Small blind put in antes (or there's the recreational variation where everyone puts in a small ante).
2. Each player is dealt five cards.

3. One round of betting, starting with the dealer's left.
4. Trade in from 0 to three cards from the remaining deck (if you have an ace you can trade 4 cards).
5. After receiving new cards, there is another round of betting.
6. Players show their hands to determine who won the pot (using standard hand rankings).

### Texas Hold'em Poker Gameplay

1. The two players to the left of the dealer put out **blind bets**. The player directly to the dealer's left puts out the small blind while the player two to the dealer's left puts out the big blind.
2. Every player is dealt two cards, face down. These are called hole or pocket cards.
3. The action, or the first move, falls on the player to the left of the big blind. She can either call the bet, raise it, or fold. Betting continues around the table, clockwise.
4. After the betting is completed, three cards are dealt face up in the center of the table, which is referred to as the **board**. The first three cards in Texas Hold'em are called the flop. These cards are "community cards" meaning everyone can (and will) use them in combination with their own hole cards to make the best hand.
5. From the flop on, betting begins with the player to the dealer's left, who can check or bet.
6. A fourth card is dealt face up onto the board. This is called fourth street or the turn card.
7. Another round of betting.
8. The final card is dealt face up. This card is also called fifth street or the river.
9. A final round of betting occurs. The remaining players show their cards and the person who can make the best five card hand by combining their pocket cards with the cards on the board wins.