

Casino games and related math

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It's important that people don't think that they can win, because you can't win in gambling. You can win for a little while but you can't win in the long run."

House edge

-Also known as the casino advantage

-The House Edge is a term used to describe the mathematical advantage that the gambling game, and therefore the commercial gambling venue, has over you as you play over time. This advantage results in an assured percentage return to the venue over time, and for you an assured percentage loss of what you bet.

-RTP and Expected value

Example

Suppose we have a fair coin flip game

Event	Odds	Payout	return
Win	50%	1	+0.5
Lose	50%	1	-0.5
		Player loss	0
		House edge	0

RTP=100%

What if the payout for winning is 90 cents?

Event	Odds	Payouts	Return
Win	50%	+0.9	+0.45
Lose	50%	-1	-0.5
		Player loss	-0.05
		House edge(-0.05/1)	5%

$$\text{RTP} = 1 - 5\% = 95\%$$

$(1 - \text{expected value betting 1 dollar}) * 100\%$



		0		
1 to 18	1st 12	1	2	3
EVEN		4	5	6
◆		7	8	9
◆	2nd 12	10	11	12
◆		13	14	15
◆		16	17	18
ODD	3rd 12	19	20	21
19 to 36		22	23	24
		25	26	27
		28	29	30
		31	32	33
		34	35	36

Type Of Casino Game	House Edge
American Roulette	5.26%
Baccarat	1.01% - 15.75%
Blackjack	0.5%
Craps	0 - 16.67%
Keno	20 - 40%
Slots	2 - 15%
Video Poker	0.46%
Caribbean Stud	5.22%
Hold'em	2.36%
Sic Bo	2.78 - 33.33%

Blackjack



Blackjack

Blackjack is a simple card game to learn, but to be good at 21, players should take a closer look at the rules. Most people assume the objective of blackjack is to get a hand as close to 21 as possible. In reality, the aim is to beat the dealer's hand without going over 21. It's a small distinction but an important one, as players can often win on lesser hands by waiting for the dealer to bust. This is just one example of how knowing blackjack rules thoroughly can help new gamblers play smarter.

House edge: 0.5%-2%

Blackjack Basic Strategy

Single Deck • American Style
 Dealer Stands on Soft 17
 Double After Split Allowed
 No Surrender

Player	Dealer's Card										
Hard	2	3	4	5	6	7	8	9	10	A	
5	H	H	H	H	H	H	H	H	H	H	H
6	H	H	H	H	H	H	H	H	H	H	H
7	H	H	H	H	H	H	H	H	H	H	H
8	H	H	H	Dh	Dh	H	H	H	H	H	H
9	Dh	Dh	Dh	Dh	Dh	H	H	H	H	H	H
10	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh	H	H	H
11	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh
12	H	H	S	S	S	H	H	H	H	H	H
13	S	S	S	S	S	H	H	H	H	H	H
14	S	S	S	S	S	H	H	H	H	H	H
15	S	S	S	S	S	H	H	H	H	H	H
16	S	S	S	S	S	H	H	H	H	H	H
17	S	S	S	S	S	S	S	S	S	S	S
18	S	S	S	S	S	S	S	S	S	S	S
19	S	S	S	S	S	S	S	S	S	S	S
20	S	S	S	S	S	S	S	S	S	S	S
21	S	S	S	S	S	S	S	S	S	S	S
Soft	2	3	4	5	6	7	8	9	10	A	
13	H	H	Dh	Dh	Dh	H	H	H	H	H	H
14	H	H	Dh	Dh	Dh	H	H	H	H	H	H
15	H	H	Dh	Dh	Dh	H	H	H	H	H	H
16	H	H	Dh	Dh	Dh	H	H	H	H	H	H
17	Dh	Dh	Dh	Dh	Dh	H	H	H	H	H	H
18	S	Ds	Ds	Ds	Ds	S	S	H	H	S	S
19	S	S	S	S	Ds	S	S	S	S	S	S
20	S	S	S	S	S	S	S	S	S	S	S
21	S	S	S	S	S	S	S	S	S	S	S
Pair	2	3	4	5	6	7	8	9	10	A	
2,2	P	P	P	P	P	P	H	H	H	H	H
3,3	P	P	P	P	P	P	H	H	H	H	H
4,4	H	H	P	P	P	H	H	H	H	H	H
5,5	Dh	Dh	Dh	Dh	Dh	Dh	Dh	Dh	H	H	H
6,6	P	P	P	P	P	P	H	H	H	H	H
7,7	P	P	P	P	P	P	H	H	S	H	H
8,8	P	P	P	P	P	P	P	P	P	P	P
9,9	P	P	P	P	P	S	P	P	S	S	S
10,10	S	S	S	S	S	S	S	S	S	S	S
A,A	P	P	P	P	P	P	P	P	P	P	P

- H** Hit
- S** Stand
- P** Split
- Dh** Double if possible, otherwise Hit
- Ds** Double if possible, otherwise Stand

Strategy by WizardOfOdds.com

Basic Strategies: cut the house edge to 0.5%

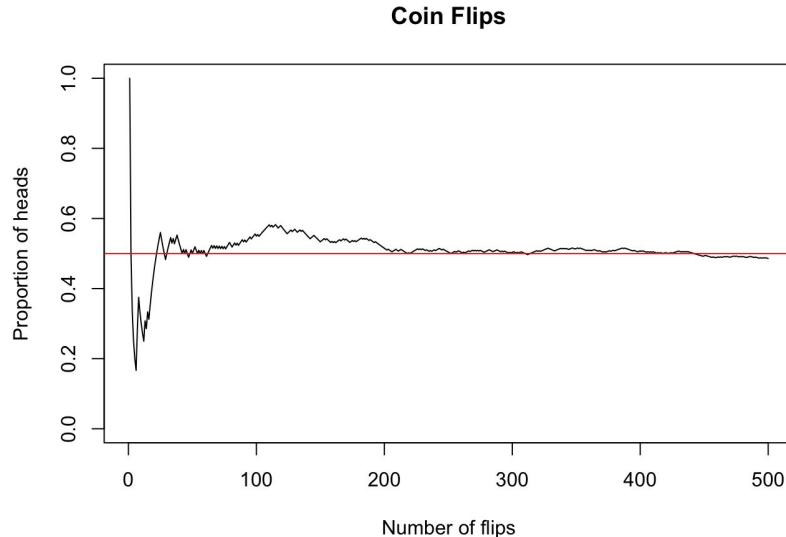
How should we bet?

Double the bet after every loss?

How should we bet?

Large number theory and gambler's fallacy:

The gambler's fallacy, also known as the Monte Carlo fallacy, **occurs when an individual erroneously believes that a certain random event is less likely or more likely to happen based on the outcome of a previous event or series of events.**



Three door problem (Monty Hall Problem)

Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?



Switch
and win



Switch
and win



Stay
and win

Player choice
before door is open

High-Low card counting strategy

-Assign a value to each card:

-2 3 4 5 6 = +1

-7 8 9 = 0

-10 J Q K A = -1

- Keep a “Running Count” based off of the values of the card dealt
- Use this information to calculate the count per deck or “true count” = Running count / decks remaining
- Change your bets as the true count rises

<https://knowyourodds.net.au/house-edge/>

<https://www.casino.org/features/house-edge/>

<https://easy.vegas/gambling/house-edge-calculation>

<https://www.onlinegambling.com/blackjack/rules/>

https://en.wikipedia.org/wiki/Monty_Hall_problem

<https://uw-statistics.github.io/Stat311Tutorial/limit-theorems.html>

[How To Count Cards in Blackjack and Bring Down the ...https://www.blackjackapprenticeship.com › how-to-cou...](https://www.blackjackapprenticeship.com/how-to-count-cards-in-blackjack/)