

# Fair and unfair: from cakes to the Super Bowl

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Math Counts

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# Probability vs percent

- What's the difference?
- Flip a coin, what's the probability that heads comes up?
- Flip a coin, what percentage of the time does heads comes up?







# Dividing a cake

- How to make it fair?
- Flip a coin. Winner gets to choose.

- How does a casino make money off of sports bets?
- What do these numbers mean?

SUN 6:30p 


**New England Patriots**  
**Atlanta Falcons**

	SPREAD	MONEYLINE	TOTAL
NE	-3 (-115) 	-145 	58 (+110)o 
ATL	+3 (-105) 	+125 	58 (-130)u 

GAME LINES | SUPER BOWL







SUPER BOWL 51. NRG Stadium Houston TX. - This game can be seen on FOX

- Say some Event  $E$  is listed as +200.
- +200 means bet 100 dollars, and if you win, you get your original 100 dollars back and an additional 200 dollars back.
- What should the probability of this happening be in order for it to be a fair bet? Answer  $100/(100 + 200)$ .
- Mathematica demo

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# Sports betting

- Say some Event  $E$  is listed as  $-200$ . What should the probability of this happening be in order for it to be a fair bet?
- $-200$  means bet 200 dollars, and if you win, you get your original 200 dollars back as well as an additional 100 dollars.
- What should the probability of this happening be in order for it to be a fair bet? Answer  $200/(200 + 100)$ .

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# Sports betting: how fair are the super bowl odds?

- odds suggest 44% chance of Falcons winning
- odds suggest 59% chance of Patriots winning
- Should add up to 100% for it to be a fair bet, but this isn't too unfair.

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# Sports betting: some more odds

- odds suggest 42% chance of Freeman winning
- odds suggest 40% chance of Blount winning
- odds suggest 25% chance of Lewis winning
- odds suggest 22% chance of Blount winning
- Add up to 129%, should be 100%, not very fair!

SUN 6:30p | Rushing Props @ Super Bowl 51

Who will record the most Rushing Yards in the game?

Devonta Freeman (ATL)	+140	LeGarrette Blount (NE)	+150	Dion Lewis (NE)	+300	+27 BETS >
Tevin Coleman (ATL)	+350					

RUSHING PROPS | SUPER BOWL - RUSHING PROPOSITIONS




All wagers have action. Listed competitors only.









# Sports betting: how fair are the super bowl odds?

- Completely fair odds do not exist in sports betting casinos.
- One of the most fair bets is the “over/under” total.
- Evidence that it’s more fair: you can choose which side to bet.
- With the rushing odds, there was no way to bet against Freeman winning, for example.

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# Dividing a cake: revisited

- How to make it fair?
- Before we used randomness (flipping a coin).
- Another way: one person divides, the other chooses.

- Each of you gets the same amount of playing chips.
- Each table has some dice and some cards
- Pick one of the cards at random: you will roll the dice as described with one other person.
- One person will choose the “over/under” total.
- The other person will decide if they want to predict “over” or “under” your total.
- Roll the dice. The winner gets the loser’s chip.

# Example

- Chris and Alessandra draw a card.
- The card says: “roll two six-sided dice and multiply them together.”
- Chris sets the over/under of 21.
- Alessandra says she wants to predict “under.”
- They roll the dice and the dice come up 6 and 2, which gives 12 when you multiply.
- Alessandra was right, so Chris gives Alessandra one of his chips.

At 8pm, the student with the most chips is declared the winner!