
TEACHING PROBABILITY WITH THE LAST BANANA

THE LAST BANANA (ADAPTED FROM TED ED)

(SOURCE: [HTTP://ED.TED.COM/LESSONS/THE-LAST-BANANA-A-THOUGHT-EXPERIMENT-IN-PROBABILITY-LEONARDO-BARICHELO](http://ed.ted.com/lessons/the-last-banana-a-thought-experiment-in-probability-leonardo-barichello))

Suppose that you're on a desert island playing dice with another castaway. The winner's prize will be the last banana. Here are the rules of the game:

- Each player rolls a die
- If the largest value shown on either die is a 1, 2, 3, or 4, then player A wins
- If the largest value shown on either die is a 5 or 6 then player B wins

1. Who has the advantage in this game: Player A, Player B, or neither? Make your best guess and explain your choice.

2. Get a partner and play this game. Play the game 20 times and record the winner of each game by tallying in the table below.

Player	A	B	Total
Tally/Count of Wins			20
Proportion of Wins			1.00

3. The process of imitating chance behavior is called a **simulation**. The long-run proportion of times that an event happens is called the **probability** of that event. Simulations are powerful tools that can be used to estimate complex probabilities. Based on the simulation by you and your partner, what is your estimate of the probability that Player A wins? that player B wins?

P(Player A wins):

P(Player B wins):

4. How do you suppose we could use simulation to obtain a more precise estimate of the probabilities in question 3?

5. Fill in the table below, combining the class data.

Player	A	B	Total
Count of Wins			
Proportion of Wins			1.00

LAWS AND MYTHS ABOUT RANDOMNESS

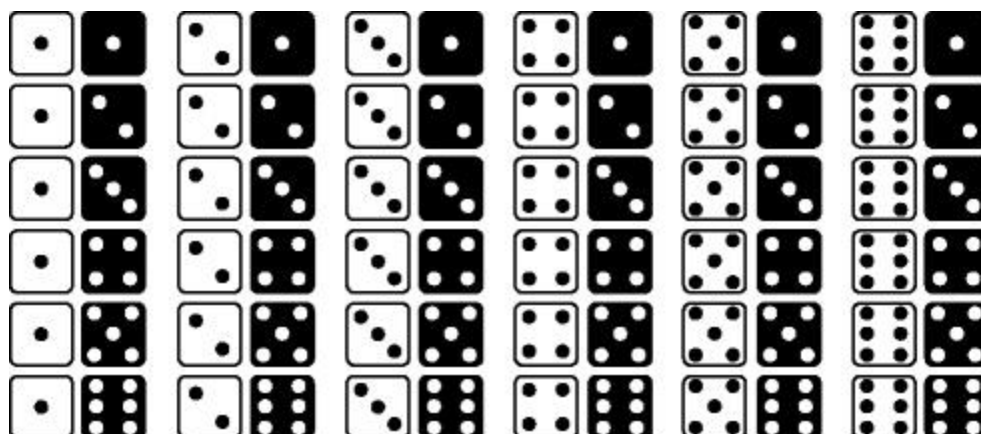
6. It turns out that random (or chance) behavior, rather than being haphazard, displays long-run patterns. Mr. Tyson will now simulate this process 5000 times using Fathom.

Player	A	B	Total
Count of Wins			
Proportion of Wins			1.00

7. Are proportions from the Fathom simulation in question 6 likely to be closer to or farther from the true probabilities than the ones you calculated in question 3? Why?

The **law of large numbers** states that as the number of repetitions of a random process (chance process) increases, the proportion of times that an event occurs will approach a particular value. That value is called the **probability** of the event.

8. It turns out that we can calculate the exact (theoretical) probabilities in this situation by listing all possible outcomes for rolling two dice. This list of all possible outcomes is called the **sample space**. Use the sample space below to calculate the theoretical probability that each player wins.



P(Player A wins):

P(Player B wins):

9. Probabilities and the law of large numbers describe long-term behavior. Short term behavior often displays behavior that is very different than what the law of large numbers predicts. Look at the file called *CoinFlippingUnfair.xlsx*. Imagine that the game you played was replaced by flipping a coin that has a $20/36 = 0.555$ chance to come up heads. What does the graph reveal about short-term and long-term behavior as they relate to probability?