5-34. RANDOM NUMBER GENERATOR

Imagine a random number generator that produces numbers from 1 to 20. In each game below, if the stated outcome happens, Player X wins. If it does not, then Player Y wins.

Game 1: A prime number = Player X wins

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 $\frac{8}{20}$

Fair →

Game 2: An even number = Player X wins

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 $\frac{1}{2}$

Game 3: A number not divisible by three = Player X wins

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 $\frac{14}{20}$

a. In each case, what is the theoretical probability that Player X wins? ~~That Player Y wins?~~ Decide whether each game above is fair.

Game 1: $\frac{8}{20}$ Not fair

Game 2: $\frac{10}{20}$ Fair game

Game 3: $\frac{14}{20}$ Not fair

b. In which of the three games is Player X most likely to win? Why?

Game 3

c. In Game 1, the prime number game, if you play 40 times, how many times would you expect Player X to win? What if you played 50 times?

$$\frac{8 \text{ wins}}{20 \text{ games}} \cdot \frac{2}{2} = \frac{16 \text{ wins}}{40 \text{ games}}$$

$$\frac{8 \text{ wins}}{20 \text{ games}} \div \frac{2}{2} = \frac{4 \text{ wins}}{10 \text{ games}} \cdot \frac{5}{5} = \frac{20 \text{ wins}}{50 \text{ games}}$$

d. Obtain a random number generator from your teacher and set it up to generate integers from 1 to 20. Play the prime number game (Game 1) ten times with a partner. Start by deciding who will be Player X and who will be Player Y. Record who wins each time you play.

How many wins at of 20 games?

8, 8, 9, 11, 7, 4, 4, 12

e. How did the experimental and theoretical probabilities of Player X's winning from part (a) and part (d) compare?

Most experimental probabilities were different than the theoretical probability.

5-35. Janelle is going to babysit her nephew all day five times this summer. She had the idea that one way to entertain him is to walk to McBurger's for a Kids Meal for lunch each time. The Kids Meal comes packed randomly with one of three possible action figures. Janelle would like to know the probability that they get all three figures in five trips.

a. Call the action figures #1, #2, and #3. Use the random number generator to simulate five trips to McBurger's. Did you get all three action figures?

5 trips

1, 2, 2, 3, 1

Happy nephew

5 trips

1, 2, 2, 1, 1

Unhappy nephew

5 trips

3, 2, 3, 1, 3

Happy nephew

b. Simulate another five trips to McBurger's. Did you get all three action figures this time? Do the simulation at least 20 times (that is, 20 sets of 5 random numbers), keeping track of how many times you got all three action figures in five tries, and how many times you did not.

c. Use your results to estimate the probability of getting all three action figures in 5 trips. Should Janelle be worried?

$\sim 2/3$ of the time

d. How could Janelle get an even more accurate estimation of the probability?

Use the RNG for 100 or more simulations.