More About Experimental and Theoretical Probabilities

You have already learned to find and compare the theoretical and experimental probabilities when conducting a probability experiment. When playing a game, you can compare the theoretical and experiment probabilities that one player will win to determine if a game is fair. In this activity, you compare the experimental and theoretical probabilities of two different games involving two events.

ACTIVITY

1 **Camren and Logan are designing a game for the school carnival. They place seven blue marbles and three red marbles in a bag. A player wins if they choose two marbles that are the same color. Play this game with a partner.**

STEP 1 Player 1 reaches into a bag and pulls out a marble. Without replacing the marble, Player 1 pulls another marble out of the bag. If both marbles are the same color, player 1 wins. If the marbles are a different color, Player 2 wins. Record the results in a table like the one shown. Place a check in the winner's column for each game.

Round	1	2	3	4	5	6	7	8	9	10
Player 1										
Player 2										

STEP 2 Player 2 replaces the marbles, and then pulls two marbles out of the bag. Record the results.

STEP 3 Continue alternating turns until 10 rounds of the game are played.

ANALYZE THE RESULTS

1. Make a list of the possible outcomes resulting from a round of the game.

2. What is the theoretical probability of Player 1 winning the first round? Player 2? Write each probability as a fraction.

3. Calculate the experimental probability of each player winning. Compare the experimental probabilities to the theoretical probabilities.

4. **MAKE A CONJECTURE** Mathematically speaking, a fair game occurs if each player has an equally likely chance of winning. Based on the theoretical probabilities, is this game fair? Explain.

ACTIVITY

2 **In a number game, Player 1 wins if the sum of the two spinners is even. Player 2 wins if the sum of the two spinners is odd. Play this game with a partner.**

STEP 1 Player 1 spins both spinners. If the sum of the two spins is even, Player 1 wins. If the sum is odd, Player 2 wins. Record the results in a table like the one shown. Place a check in the winner's column for each round of the game.

Round	1	2	3	4	5	6	7	8	9	10
Player 1										
Player 2										

STEP 2 Player 2 spins both spinners and then records the results.

STEP 3 Continue alternating turns until 10 rounds of the game are played.

ANALYZE THE RESULTS

5. Make a list of the possible outcomes resulting from a round of the game. Explain your method.

6. Calculate the theoretical probability of each player winning. Write each probability as a fraction.

7. Calculate the experimental probability of each player winning. Compare the experimental probabilities to the theoretical probabilities.

8. **MAKE A CONJECTURE** Based on the theoretical probabilities if each player winning is this game fair? Explain your reasoning.

9. **OPEN ENDED** Design a game where the winner of each round is determined by the results of three simple events. Calculate the theoretical probability of each player winning. Then play 10 rounds of the game with a partner. Calculate the experimental probability of each player winning. Is your game fair or unfair? Explain.