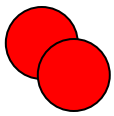
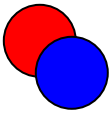
Is It Fair?

NAME _____

Two people in your group are going to play a game. Others in your group will observe and record data. Before you play, read the directions and discuss Question 1 with your group.

Directions: Put a red-red and a red-blue chip in a cup. Take turns shaking and tossing the chips. Player A scores a point if both chips land with the red side up. Player B gets a point if one of each color lands up. The first player with ten points wins the game.

 Player A gets 1 point

 Player B gets 1 point

1. Do you think this game is fair? Why? Make a prediction before playing.

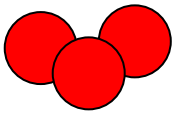
Play at least five games. Tally your results. Calculate the relative frequency of each player's winning.

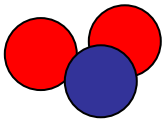
GAME	PLAYER 1	PLAYER 2
1		
2		
3		
4		
5		
6		
7		
8		

2. On the basis of these trials, do you think the game is fair?

3. Analyze the game by listing all possible outcomes or drawing a tree diagram. Find the theoretical chance of winning for each player.

Now, add another red-red chip to the cup. In this game, if all three chips show red, player A scores a point; otherwise, player B scores a point.

 Player A gets 1 point

 Player B gets 1 point

4. Is this game fair? Discuss with your group before you play.

Play the game, and record and study the results.

GAME	PLAYER 1	PLAYER 2
1		
2		
3		
4		
5		
6		
7		
8		

5. List all outcomes and find each player's chance of winning. Is the game fair?

6. Suppose a red-red and two red-blue chips are used. How does this change the outcomes? Is the game fair?

Try this game with three chips. Use a red-white, red-blue, and white-blue chip. Player A scores if all three chips are different colors, and player B scores a point if two chips match.

7. Predict the fairness of this game. Discuss your reasons before playing.

Play and record at least five games. Find the relative frequency of each player's winning to decide if the game appears to be fair.

GAME	PLAYER 1	PLAYER 2
1		
2		
3		
4		
5		
6		
7		
8		

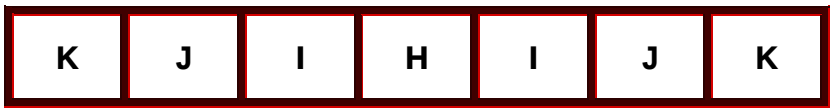
8. How many outcomes are possible for this game? Make a tree diagram to help find the theoretical probability for each player.

9. If this game is not fair, how would you change the scoring to make it fair?

A Fair Hopper

NAME _____

This game is played on the following game board. Study the game and answer Question 1.



To begin each turn, place a chip on the home (H) square. Each turn consists of tossing a coin three times. For each toss, if the coin lands *heads*, move the chip — or the "hopper," — to the right. If the coin lands *tails*, move the hopper to the left.

After three tosses, player A scores a point if the chip is on either I square. Player B scores a point if the chip lands on the H, J, or K squares. A game consists of ten turns.

1. Predict who will win. Does the game appear to be fair? Why?

Play the game. Record the results for each turn in a chart for each player.

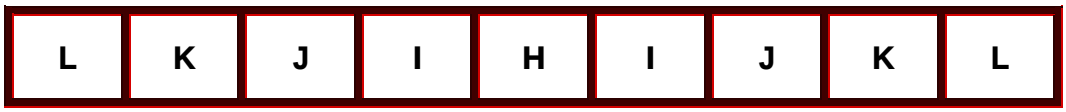
TURN	PLAYER A	PLAYER B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

2. On the basis of the data, does the game seem fair?

3. Use a tree diagram to list all possible outcomes. How many outcomes are possible? For each branch of the tree diagram, decide on which square the hopper lands. Use your analysis to determine the fairness of the game. Write a brief report of your results.

4. If "hopper" is not a fair game, how could you change it to make it fair?

Suppose that a coin is tossed four times and a longer board is used (add a square labeled L at each end). Player A scores a point if the hopper lands on I or L, and player B scores a point if the hopper lands on H, J, or K.



5. Predict the winner. Explain your reasoning.

Play the game. Record and study the results.

TURN	PLAYER A	PLAYER B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

6. Does the game appear to be fair?

7. Use a tree diagram to analyze the outcomes. Are you surprised?

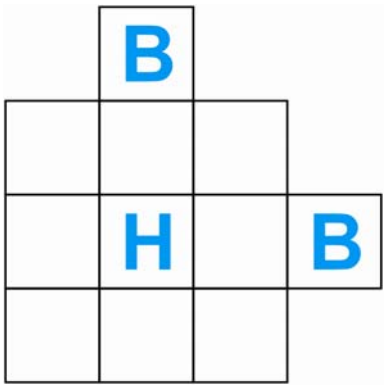
8. What do you think will happen if a longer board is used and the coin is tossed five times?

9. Make up a different game that is based on the “hopper” idea. Analyze your game to determine if it is fair. Present your game to other students, and analyze it for fairness.

Can A Happy Hopper Escape?

NAME _____

Imagine a hopper stranded on a three-by-three-square island. The island can be left safely via two bridges (labeled B). To play this game, you will need a chip (a "happy hopper") with an arrow marked on the top.



To begin the game, place the happy hopper (with the arrow pointing up) on the home (H) square. For each turn, toss a coin twice. On the first toss, rotate the hopper according to whether the coin lands head up or tail up (see below). On the second toss, move the hopper.

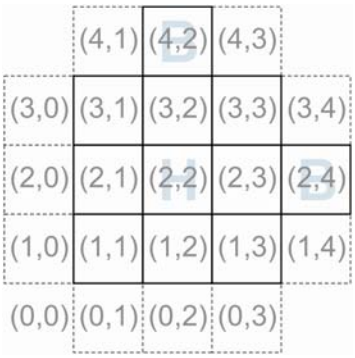
First Toss
Heads: Rotate the arrow 90º counterclockwise
Tails: Rotate the arrow 90º clockwise

Second Toss
Heads: Move the chip one square in the direction of the arrow without turning it
Tails: Move the chip one square in the direction *opposite* the arrow without turning it

Play until the happy hopper lands on a bridge or hops into the sea.

1. Does the happy hopper have a fair chance to escape by way of a bridge? Make your prediction before playing.

Play the game at least five times. Record the sequence of squares on which the happy hopper lands in the table below. Use ordered pairs (rows, columns) as shown in the figure at the right.



GAME	SEQUENCE OF SQUARES
1	
2	
3	
4	
5	

2. Is the game fair?

3. Suppose that the island has two more bridges attached to squares (2, 1) and (0, 2). How would this modification change the chances of escape? Make a prediction.

Play the game at least five times, and again record the results.

GAME	SEQUENCE OF SQUARES
1	
2	
3	
4	
5	

4. Examining your data, do you think the game is fair?

5. Investigate a five-by-five island with two bridges. How does this extension change the chances for the happy hopper's escape?

6. For a five-by-five island, how many bridges would you add, and where would you place them, to make the game fair?