Activity 8: Simulate It

PURPOSE Analyze probability situations using simulations.

MATERIALS One die

GROUPING Work individually or in pairs.

DESIGNING A SIMULATION

Robin Hood and Maid Marian are having an archery contest. They alternate turns shooting at a target. The first person to hit it wins. The probability that Robin hits the target is $\frac{1}{3}$ and the probability that Marian hits it is $\frac{2}{5}$. Since Marian is the better archer, Robin shoots first. What is the probability that Marian will win the contest? On average, how many shots will be necessary to determine a winner? To find the answers, you can simulate the problem.

Step 1: Select a model.

- To simulate Robin's shot, roll a die. If the result is a 1 or 2, he hits the target. Otherwise he misses.
- For Marian's shot, roll a die. If the outcome is a 1 or 2, she hits the target. If it is a 3, 4, or 5, she misses. If it is a 6, roll the die again.

Step 2: Conduct a trial and record the result.

A trial consists of rolling a die to alternately simulate a shot for Robin and then one for Marian until someone hits the target.

Example:	**Shot**	**Archer**	**Die Roll**	**Result**
	1	Robin	4	Miss
	2	Marian	6	Roll Again
			5	Miss
	3	Robin	1	Hit—Robin Wins!

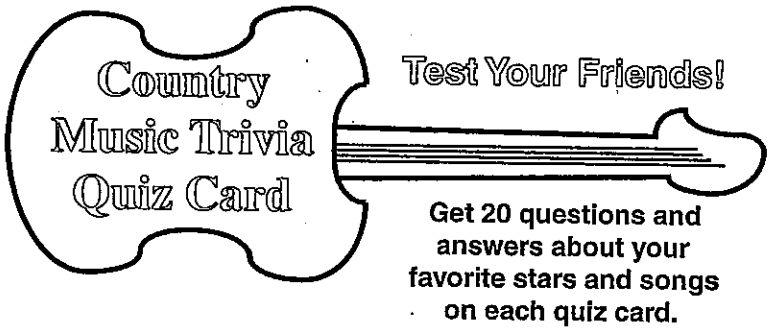
Step 3: Repeat Step 2 until the desired number of trials is completed.

Complete 30 trials and record the results in a table like the one below.

Trial	Winner	Number of Shots	Trial	Winner	Number of Shots
Example	Robin	3			

Step 4: Interpret the results.

Based on the results of the 30 trials, what is the probability that Robin wins the contest? What is the average number of shots for the 30 trials?



As part of a promotional campaign, a cereal manufacturer packages one Country Music Trivia Quiz Card inside each specially labeled box of cereal.

A country music aficionado wants to collect a complete set of the Country Music Trivia Quiz Cards. He wants to estimate how many boxes of cereal he will need to purchase in order to collect all four Quiz Cards.

1. Describe how the card obtained by purchasing one box of cereal can be modeled by rolling a die.

2. What would make up a trial?

3. Complete 20 trials and record the results in a table like the one below.

Trial	Number of Boxes	Trial	Number of Boxes

4. On average, how many boxes of cereal will the aficionado have to purchase in order to collect a complete set of four Country Music Trivia Quiz Cards?

5. Describe a model that could be used if one card was twice as likely to be in a box of cereal as the others.

6. In this case, what would make up a trial?

EXTENSION Suppose Robin and Marian change the rules of their tournament so that the winner is the person who wins two out of three contests. Draw a tree diagram to show the possible outcomes of the tournament. Use the results from the archery simulation to assign probabilities to the branches and determine the probability that Marian wins the tournament.