12.5 Using Simulations to Determine Probability

You will need
- a spinner

GOAL
Choose a model to determine the probability of a real-life event.

Learn about the Math

Yan has a batting average of 0.250. Kelly has a batting average of 0.333. Both students hope to get at least three hits in the next five times they are up to bat. They decide to use a **simulation** to determine the probability of getting three or more hits in five times at bat.

simulation
an experiment that models an actual event

? What is the probability that Yan will get three or more hits in five times at bat?

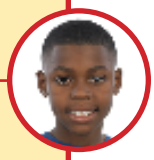
Example 1: Simulating using a spinner

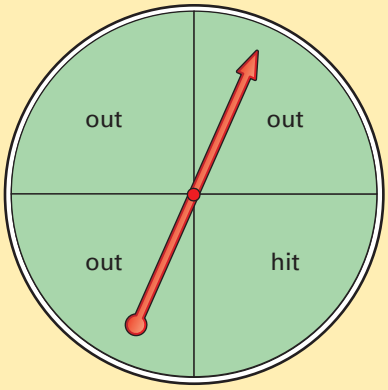
Determine each experimental probability.

a) Yan getting at least three hits in the next five times he is up to bat.

b) Yan getting less than three hits in the next five times he is up to bat.

Kito's Solution





Three or more hits in five spins	Less than three hits in five spins
II	卌 卌 卌 III

Yan's batting average is 0.250, or $\frac{1}{4}$. For every four times at bat, he usually gets one hit and three outs.

I used five spins of a spinner with four equal parts to model Yan's next five times at bat. I recorded whether or not there were three or more hits. I repeated the five spins 20 times.

a) The experimental probability of Yan getting three or more hits is $\frac{2}{20}$, or $\frac{1}{10}$.

b) The experimental probability of Yan getting less than three hits is $\frac{18}{20}$, or $\frac{9}{10}$.

Example 2: Simulating using a four-sided die

Determine the experimental probability of Yan getting at least three hits in the next five times he is up to bat.

Rowyn's Solution

Three or more hits	Less than three hits
3	33

With a 0.250 batting average, Yan has a 25% chance of getting a hit and a 75% chance of getting out.

For the simulation, I chose a tetrahedral die since it has four faces. I rolled the die five times for each trial. The numbers 1, 2, and 3 represented outs. The number 4 represented a hit.

After 36 trials, I calculated the experimental probability of getting three or more hits to be $\frac{3}{36}$, or $\frac{1}{12}$.

Reflecting

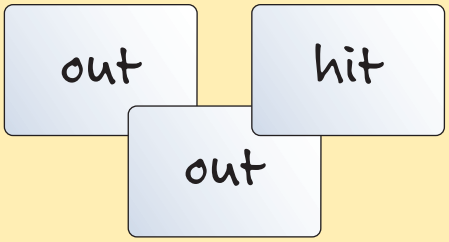
1. Explain why each simulation is appropriate for the situation.
2. Why would a standard six-sided die not be as good a model for the situation?

Work with the Math

Example 3: Simulating using labelled cards

Determine the experimental probability of Kelly getting at least three hits in the next five times she goes to bat.

Carina's Solution



Three or more hits	Less than three hits
4	20

I made these three cards because Kelly's batting average is 0.333, or $\frac{1}{3}$. I put the cards in a bag.

Then I drew a card from the bag five times and replaced the card. I recorded whether or not there were three or more hits.

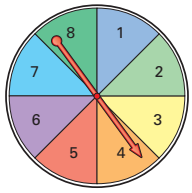
After 24 trials, I calculated the experimental probability to be $\frac{4}{24}$, or $\frac{1}{6}$, or about 16.7%.

A Checking

3. Which model(s) could be used to simulate the experimental probability for each situation below?

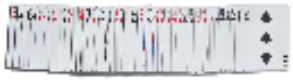
A.

C.



B.

D.



a) If six runners in a race have equal ability, the tallest runner will win the race.

b) The week that your name is drawn in a weekly prize draw will be the week of your birthday.

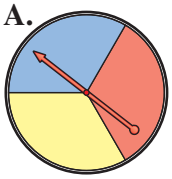
c) It will rain tomorrow if the forecast is a 50% chance of rain.

d) You will find a prize in your cereal box if there is a prize in every eighth box.

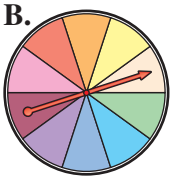
B Practising

4. Which spinner(s) could be used to simulate the experimental probability for each situation?

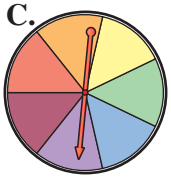
A.



B.



C.



a) You have volunteered to help out one day at a weeklong summer festival. What is the probability that the day assigned to you will be Wednesday if the days are assigned randomly?

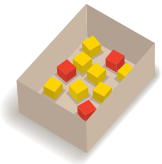
b) In a game of chance that is played in pairs, you can win, lose, or tie with equal likelihood. What is the probability that you will win three games in a row?

c) According to a poll, two of the candidates for mayor each have 30% of the votes. The third candidate has 40% of the votes. What is the probability that the third candidate will win the election?

5. Which model(s) could be used to determine the probability of each event? Justify your choices.

A.

B.



C.

a) You will select the only red jellybean in a bag of 26 jellybeans.

b) You will score $\frac{10}{10}$ on a true/false quiz by guessing.

c) A family with four children has all girls.

d) The next three days will be rainy if a 30% chance of rain is forecast for all three days.

C Extending

6. Francine wondered if the next three people to walk into a room would all be male. She simulated this situation by flipping a coin three times. Heads represented males, and Tails represented females. Explain how you could simulate the same situation using each model below.

a) dice

b) playing cards

c) a spinner

d) a bag of marbles