# Lesson 2: Estimating Probabilities by Collecting Data

Classwork

Example 1: Carnival Game

At the school carnival, there is a game in which students spin a large spinner. The spinner has four equal sections numbered 1–4 as shown below. To play the game, a student spins the spinner twice and adds the two numbers that the spinner lands on. If the sum is greater than or equal to 5, the student wins a prize.
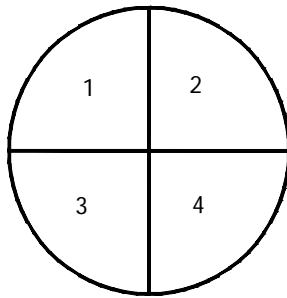
Exercises 1–8

You and your partner will play this game 15 times. Record the outcome of each spin in the table below.

Turn	1st Spin Results	2nd Spin Results	Sum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

1. Out of the 15 turns how many times was the sum greater than or equal to 5?

2. What sum occurred most often?

3. What sum occurred least often?

4. If students were to play a lot of games, what proportion of the games would they win? Explain your answer.

5. Name a sum that would be impossible to get while playing the game.

6. What event is certain to occur while playing the game?

When you were spinning the spinner and recording the outcomes, you were performing a *chance experiment*. You can use the results from a chance experiment to estimate the probability of an event. In the example above, you spun the spinner 15 times and counted how many times the sum was greater than or equal to 5. An estimate for the probability of a sum greater than or equal to 5 is

$$P(\text{sum} \geq 5) = \frac{\text{Number of observed occurrences of the event}}{\text{Total number of observations}}.$$

7. Based on your experiment of playing the game, what is your estimate for the probability of getting a sum of 5 or more?

8. Based on your experiment of playing the game, what is your estimate for the probability of getting a sum of exactly 5?

Example 2: Animal Crackers

A student brought a very large jar of animal crackers to share with students in class. Rather than count and sort all the different types of crackers, the student randomly chose 20 crackers and found the following counts for the different types of animal crackers. Estimate the probability of selecting a zebra.

Lion	2
Camel	1
Monkey	4
Elephant	5
Zebra	3
Penguin	3
Tortoise	2
	Total 20

Exercises 9–15

If a student randomly selected a cracker from a large jar:

9.   What is your estimate for the probability of selecting a lion?

10. What is your estimate for the probability of selecting a monkey?

11. What is your estimate for the probability of selecting a penguin or a camel?

12. What is your estimate for the probability of selecting a rabbit?

13. Is there the same number of each kind of animal cracker in the large jar? Explain your answer.

14. If the student randomly selected another 20 animal crackers, would the same results occur? Why or why not?

15. If there are 500 animal crackers in the jar, how many elephants are in the jar? Explain your answer.
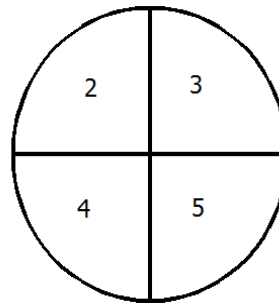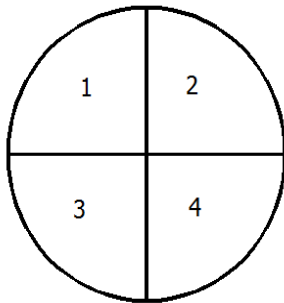
> **Lesson Summary**
>
> An estimate for finding the probability of an event occurring is
>
> $$P(\text{event occurring}) = \frac{\text{Number of observed occurrences of the event}}{\text{Total number of observations}}.$$

Problem Set

1. Play a game using the two spinners below. Spin each spinner once, and then multiply the outcomes together. If the result is less than or equal to 8, you win the game. Play the game 15 times, and record your results in the table below. Then, answer the questions that follow.

Turn	1ˢᵗ Spin Results	2ⁿᵈ Spin Results	Product
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

   a.   What is your estimate for the probability of getting a product of 8 or less?

   b.   What is your estimate for the probability of getting a product of more than 8?

   c.   What is your estimate for the probability of getting a product of exactly 8?

   d.   What is the most likely product for this game?

   e.   If you play this game another 15 times, will you get the exact same results? Explain.

2.   A seventh-grade student surveyed students at her school. She asked them to name their favorite pet. Below is a bar graph showing the results of the survey.
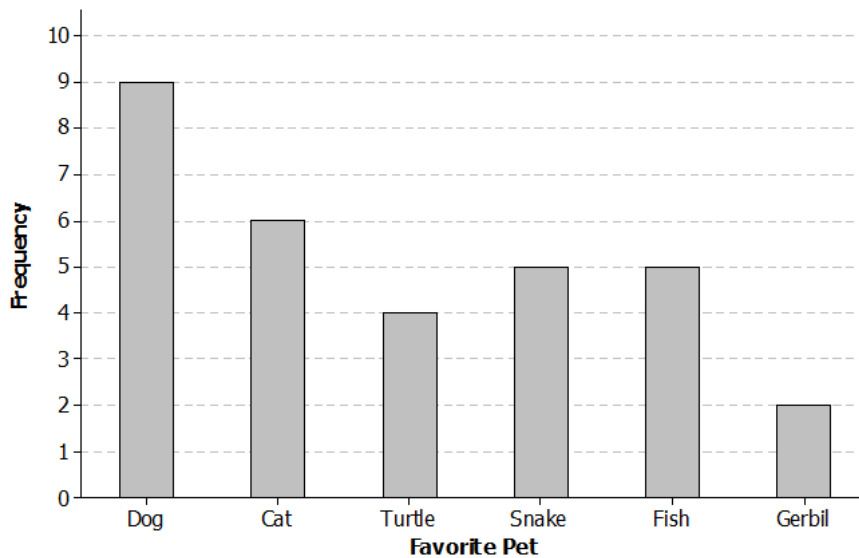
Use the results from the survey to answer the following questions.

   a.   How many students answered the survey question?

   b.   How many students said that a snake was their favorite pet?
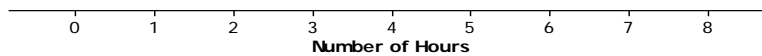

Now suppose a student will be randomly selected and asked what his favorite pet is.

   c.   What is your estimate for the probability of that student saying that a dog is his favorite pet?

   d.   What is your estimate for the probability of that student saying that a gerbil is his favorite pet?

   e.   What is your estimate for the probability of that student saying that a frog is his favorite pet?

3. A seventh-grade student surveyed 25 students at her school. She asked them how many hours a week they spend playing a sport or game outdoors. The results are listed in the table below.

Number of hours	Tally	Frequency
0	| | |	3
1	| | | |	4
2	⊬⊬⊬	5
3	⊬⊬⊬ | |	7
4	| | |	3
5		0
6	| |	2
7		0
8	|	1

a. Draw a dot plot of the results

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     0    1    2    3    4    5    6    7    8
                  Number of Hours
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Suppose a student will be randomly selected.

b. What is your estimate for the probability of that student answering 3 hours?

c. What is your estimate for the probability of that student answering 8 hours?

d. What is your estimate for the probability of that student answering 6 or more hours?

e. What is your estimate for the probability of that student answering 3 or fewer hours?

f. If another 25 students were surveyed do you think they would give the exact same results? Explain your answer.

g. If there are 200 students at the school, what is your estimate for the number of students who would say they play a sport or game outdoors 3 hours per week? Explain your answer.

4. A student played a game using one of the spinners below. The table shows the results of 15 spins. Which spinner did the student use? Give a reason for your answer.

Spin	Results
1	1
2	1
3	2
4	3
5	1
6	2
7	3
8	2
9	2
10	1
11	2
12	2
13	1
14	3
15	1

Spinner A

Spinner B

Spinner C