

Applications



Classify each variable as categorical (C) or numerical (N).

1. number of text messages you send in a day
2. brands of breakfast cereal
3. heights of students in your class
4. daily maximum temperature for your city
5. breeds of dogs
6. number of hours you sleep each night
7. types of flowers available from a florist
8. number of oranges in the 5-lb bags at a supermarket
9. heights of trees that were planted one year ago
10. number of students absent from school each day for one month

List possible categories for each categorical variable.

11. types of cars
12. methods of travel to school
13. types of instruments in an orchestra
14. sports played at school

15. You can analyze data in many ways, using graphs, tables, measures of center, and measures of spread.

<u>Graphs</u>	<u>Tables</u>	<u>Measures of Center</u>	<u>Measures of Spread</u>
bar graphs	frequency table	mean	range
circle graphs	two-way table	median	interquartile range
dot plots		mode	MAD
line plots			SD
histogram			
box plot			
scatter plot			
line graph			

Make a table similar to the one below. Enter the types of graphs, measures of center, and measures of spread you can use with each data type.

<u>What can I use?</u>	
<u>Categorical Data</u>	<u>Numerical Data</u>
Graphs:	Graphs:
Measures of center:	Measures of center:
Measures of spread:	Measures of spread:

Exercises 16 and 17 use the survival rate data of men, women, and children on the *Titanic*.

Passenger Category	Saved	Lost
Men	338	1,352
Women	316	109
Children	56	53

16. Which of these claims about survival rates on the *Titanic* are true? Explain your reasoning.
- More men than women were saved.
 - Women were more likely than children to be lost.
 - Men were about six times as likely to be saved as children.
17. Another way to see whether men, women, and children were lost at the same rate is to find the overall survival rate for all *Titanic* passengers. Use the overall rate to find expected survival counts for each passenger category. Overall, 32% of passengers were saved and 68% lost their lives.
- Use the total numbers of men, women, and children on board the *Titanic* and use the overall survival rates. Copy and complete the table below.

Passenger Category	Expected Saved	Expected Lost
Men	■	■
Women	■	■
Children	■	■

- Compare the table in part (a) with the data table. Which passenger categories had greater numbers of survivors than you would expect if all categories had the same proportion? Explain.

18. Suppose you are interested in learning about the effects of parents' smoking habits on their adult children. Use the data from the table below.

	Adult children smoke	Adult children do not smoke	Total	Percent of adult children who smoke
Both parents smoke	400	1,380	■	■
One parent smokes	416	1,823	■	■
Neither parent smokes	188	1,168	■	■
Total	■	■	■	■
Percent of adults with at least one parent who smokes	■	■	■	■

- Copy and complete the table.
- Find the percent of adult children who smoke in each situation.
 - both parents smoke
 - one parent smokes
 - neither parent smokes
- Draw a bar graph to compare the three percents you found in part (b).
- Does the table show evidence that if parents smoke, then their adult children are more likely to be smokers? Explain.
- Does the table show evidence that if only one parent smokes, their adult children are more likely to be smokers? Explain.
- Does the table show evidence that adult children of nonsmoking parents are smokers? Explain.

19. The table below compares a treatment for rheumatoid arthritis to a placebo. A *placebo* is a treatment that has no medicine. The outcome of the experiment reflects whether individuals showed *no improvement*, *some improvement*, or *marked improvement* taking either the placebo or the active medicine.

Does the table show evidence that a person given the active treatment is more likely to show at least some improvement than a person given the placebo? Explain.

Treatment	Improvement			Total
	None	Some	Marked	
Active	14 32.6%	7 16.3%	22 51.1%	43
Placebo	28 68.3%	6 14.6%	7 17.1%	41
Total	42	13	29	84

Connections



20. Fifty households on a street were asked which brand of television they owned. The table shows the results from the survey.

TV Brands	A	B	C	D	E	F
TV Owners	9	4	12	8	7	10

- Draw a horizontal bar graph of the data.
- Suppose you wanted to use the data to determine buying patterns of people living in the city. Is it possible that this sample is *biased* for particular TV brands? Explain your reasoning.
- Which measures—mode, median, or mean—would you use to describe the typical television brand owned? Explain.

21. The circle graph shows the results of a survey in which people were asked, "What is your favorite fruit?" The angle of 68° represents 277 people who said their favorite fruit is oranges. Find the sample size used to the nearest 10 people.



Find the measure of the angle of a circle graph for each frequency.

22. 23 in a sample of 180
23. 128 in a sample of 720
24. 238 in a sample of 1,250
25. A gymnast received scores from five judges in the state competition.
Parallel Bars: 7.6, 8.2, 8.5, 8.2, and 8.9
- What happens to the mean of scores when you multiply each data point by 2? By $\frac{2}{3}$? By 0.2?
 - Why do you think the mean changes like that? Explain.
26. **Multiple Choice** A store owner keeps a tally of the sizes of shoes bought at her store. Which measure of central tendency best describes the average shoe size sold?
- A. mean B. mode C. median D. range
27. **Multiple Choice** Suppose all the students who took a math test yesterday scored over 75. Three students missed the test. Their scores are listed as 0 until they take the test. Which measure best represents the data?
- F. mean G. range H. median J. standard deviation
28. **Multiple Choice** A bag contains red and black chips. The probability of selecting a red chip from the bag is $\frac{1}{4}$. What is the probability of drawing a black chip?
- A. $\frac{1}{4}$ B. $\frac{1}{2}$ C. $\frac{3}{4}$ D. None of these
29. A student scored 40 out of 100 points on this week's test. Her teacher announced that this week's test will be averaged with next week's test. Can the student still get a C if she scores a 100 on next week's test? The lowest C is 70 points. She reasons, "My average will be 70, a C, because half of 40 is 20 and half of 100 is 50 and 20 plus 50 is 70." Does her method always work? Explain.

30. **Multiple Choice** Which situation can be represented using a scatter plot?
- F. Jennifer keeps a list of the amount of time she spends on her social studies homework each day.
 - G. Mr. Jones wants to see if his students' shoe sizes are directly related to their heights.
 - H. Mr. DiSanti records his customers' best video game scores during the summer.
 - J. Sam keeps track of his algebra grades for the quarter.
31. a. Make a scatter plot of the data in the table below.

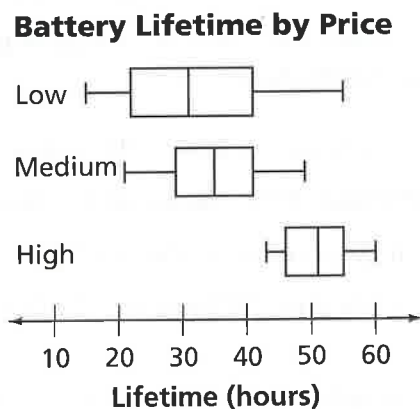
Hours at Mall	10	8	9	3	1	2	5	6	7	8	2	3
Dollars Spent	42	14	25	21	9	32	50	60	16	22	100	45

- b. What type of correlation (positive, negative, or zero) exists between the number of hours spent in the mall and the number of dollars spent?

Extensions

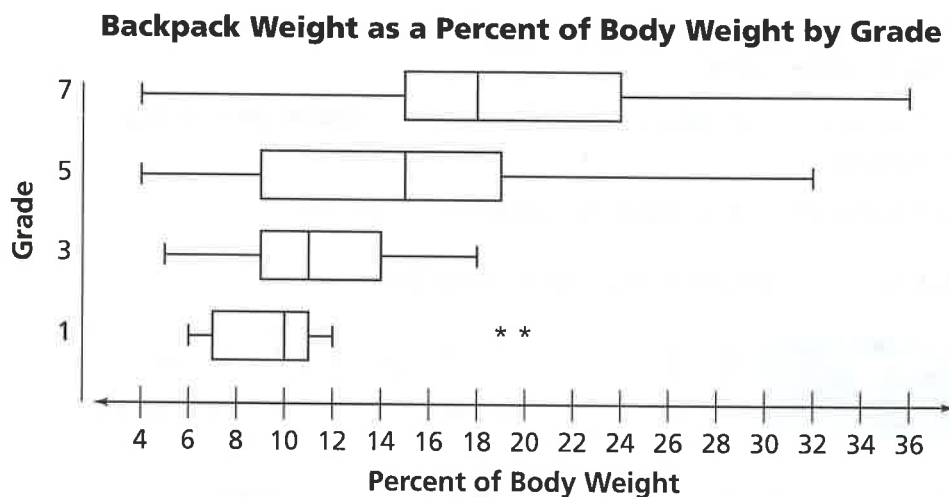


32. The triple box plot below shows the distribution of the lifetime (in hours) of three different batteries (low, medium, and high price).



- a. The two variables in the box plot are *battery lifetime* and *battery price*. Which variable is numerical and which is categorical?
- b. Does the graph support the claim that battery life depends on price? Explain your thinking.

33. Students collected two sets of data, the weight of a student and the weight of the student's backpack, from Grades 1, 3, 5, and 7. Then they computed the ratio of backpack weight to student weight as a percent. The graph below shows the data.



- Which box plot has the greatest interquartile range? What does this tell you about the middle 50% of the backpack weights for that grade compared to the other grades?
 - What is the median of the data for Grade 1? What does this tell you about the data for these students?
 - Suppose that some health officials claim that backpacks should be only 15% of a student's weight. From the graph, are there any grades for which this is *not* the case? If so, which grades? Explain.
 - Do the box plots support the claim that students at higher grades tend to carry heavier backpacks? Explain.
34. A survey of people's favorite colors reported the results below.
Red: 12% **Orange:** 14% **Purple:** 28% **Blue:** 30% **Green:** 16%
- Make a circle graph and a bar graph to show the results.
 - How do you use percents to make the circle graph? The bar graph?
 - What is the least number of people who could have taken the survey? Explain.

Mathematical Reflections

5

In this Investigation you analyzed data in two-way tables to find similarities and differences in groups. You learned how to draw accurate conclusions from these data arrays. The following questions will help you summarize what you have learned.

Think about these questions. Discuss your ideas with other students and your teacher. Then write a summary of your findings in your notebook.

1. **What** are categorical variables and what do they measure?
2. **Suppose** a survey asked teenagers and adults whether or not they use text messaging.
 - a. **How** could you arrange the data to compare the groups?
 - b. **How** would you decide that the two groups—teenagers and adults—were different in their use of text messaging?
 - c. **Suppose** that one analysis compared only the numbers in each group—teenage text messenger, teenage non-text messenger, adult text messenger, and adult non-text messenger. How might the analysis result in misleading conclusions?



Common Core Mathematical Practices

As you worked on the Problems in this Investigation, you used prior knowledge to make sense of them. You also applied Mathematical Practices to solve the Problems. Think back over your work, the ways you thought about the Problems, and how you used Mathematical Practices.

Tori described her thoughts in the following way:

In Problem 5.1, Question A, we were confused about how to make sense of the data presented in the table showing customers' preferences about which kind of roller coaster they like to ride. The data are grouped in two age categories.

Jen wondered how many customers were surveyed. So we decided to add up columns first. We saw that 60 customers prefer wood coasters and 80 customers prefer steel coasters. Then we added up rows. We saw that there were 105 customers surveyed who were 40 or younger; there were 35 customers who were older than that.

So when we find the total number of preferences separated by kind of coaster, does it equal the total number of customers separated by age? It does! We think 140 customers were surveyed.

.....
Common Core Standards for Mathematical Practice

MP4 Model with mathematics.



- What other Mathematical Practices can you identify in Tori's reasoning?
- Describe a Mathematical Practice that you and your classmates used to solve a different Problem in this Investigation.