Applications

For Exercises 1–4, describe the population, the sampling plan, and the sample.

1. A magazine for teenagers asks its readers to write in with information about how they solve personal problems.

2. An 8th-grade class wants to find out how much time middle-school students spend on the telephone each day. Students in the class keep a record of the amount of time they spend on the phone each day for a week.

3. Ms. Darnell’s class wants to estimate the number of soft drinks middle-school students drink each day. They obtain a list of students in the school and write each name on a card. They put the cards in a box and select the names of 40 students to survey.

4. The newspaper below gives information about how adults feel about global warming. The editors of the school paper want to find out how students feel about this issue. They select 26 students for their survey—one whose name begins with A, one whose name begins with B, one whose name begins with C, and so on.
A middle school has 350 students. One math class decides to investigate how many hours a typical student in the school spent doing homework last week. Several students suggest sampling plans. For Exercises 5–8, name the type of sampling plan. Then tell whether you think the sampling plan would give a representative sample.

5. Zak suggests surveying every third student on each homeroom class list.

6. Kwang-Hee suggests putting 320 white beans and 30 red beans in a bag. Each student would draw a bean as he or she enters the auditorium for an assembly. The 30 students who draw red beans will be surveyed.

7. Ushio suggests that each student in the class survey everyone in his or her English class.

8. Kirby suggests putting surveys on a table at lunch and asking students to return completed questionnaires at the end of the day.

9. A radio host asked her listeners to call in to express their opinions about a local election. What kind of sampling plan is she using? Do you think the results of this survey could be used to describe the opinions of all the show’s listeners? Explain.

Manufacturers often conduct quality-control tests on samples of their products. For Exercises 10–13, describe a random sampling plan you would recommend to the company. Justify your recommendation.

10. A toy company produces 5,000 video-game systems each day.

11. A music company manufactures a total of 200,000 compact discs for about 100 recording artists each day.

12. A fireworks company produces over 1,500 rockets each day.

13. A bottling company produces 25,000 bottles of spring water each day.
14. Use the table from Problem 2.3.
   a. Suppose you select the first 30 students for a sample. A second student selects the next 30 students for a different sample, and so on. Will these samples be representative? Explain.
   b. You select students 1, 5, 9, 13, 17, 21, 25, . . . for your sample. A second student chooses students 2, 6, 10, 14, 18, 22, 26, . . . for his sample. A third student chooses students 3, 7, 11, 15, 19, 23, 27, . . . for her sample, and so on. Will this result in representative samples? Explain.

15. a. The homecoming committee wants to estimate how many students will attend the homecoming dance. It does not, however, want to ask every student in the school. Describe a method the committee could use to select a sample of students to survey.
   b. Describe how the committee could use the results of its survey to predict the number of students who will attend the dance.

16. Use the graph below. About how many more hours per day does a typical newborn sleep than a typical 10- to 13-year-old?

   ![Typical Amount of Time Children Sleep](image)

17. Suppose you want to survey students in your school to find out how many hours they sleep each night. Which would be the best sample size: 5 students, 10 students, or 30 students? Explain.
18. The scoreboard below displays Ella’s diving scores from a recent competition. One score cannot be read.

These statistics summarize Ella’s diving scores:
mean = 6.75 points  median = 6.85 points  range = 3.2 points

What was Ella’s missing score for the competition? Explain.

19. Between ages 5 and 18, the average student eats 1,500 peanut butter and jelly sandwiches. You can make about 15 sandwiches from an 18-ounce jar of peanut butter.

a. How many 18-ounce jars of peanut butter would you need to make 1,500 sandwiches? Explain.

b. From age 5 to age 18, about how many 18-ounce jars of peanut butter does an average student eat each year?

c. How many peanut butter sandwiches does a student need to eat each week to consume the number of jars per year from part (b)?
For Exercises 20–22, use the two dot plots below. The dot plots show the number of hours students spent doing homework on Monday.

20. Find the median homework times. Copy and complete the table below.

<table>
<thead>
<tr>
<th>Time Spent on Homework (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

21. a. For each grade, describe the variability in the distribution of homework times. Use what you know about the distribution’s shape and the MAD.

b. Use statistics to compare the times 6th graders spent doing homework to the times 7th graders spent doing homework.

22. Could these data be used to describe the time spent on homework on a typical school night by a typical student in each grade? Explain.
23. Consider the following data set: 20, 22, 23, 23, 24, 24, and 25.
   a. Find the mean and the range of the values.
   b. Add three data values to the data set so that the mean of the new data set is greater than the mean of the original data set. What is the range of the new data set?
   c. Add three data values to the original data set so that the mean of the new data set is less than the mean of the original data set. What is the range of the new data set?
   d. How do the ranges of the three data sets compare? Why do you think this is so?

24. **Multiple Choice** Suppose you survey 30 students from a population of 150 students in the 7th grade. Which statement is false?
   A. The ratio of those sampled to those not sampled is 30 to 120.
   B. One out of every five people in the population was sampled.
   C. Twenty-five percent of the students in the population were sampled.
   D. One-fifth of the students in the population were sampled.

25. There are 350 students in a school. Ms. Cabral’s class surveys two random samples of students to find out how many went to camp last summer. The results are below.
   **Sample 1:** 8 of 25 attended camp.
   **Sample 2:** 7 of 28 attended camp.
   a. Use the results from Sample 1. What fraction of the students in the school do you think attended camp? How many students attended camp?
   b. Use the results from Sample 2. What fraction of the students in the school do you think attended camp? How many students attended camp?
   c. Which sample concludes that the greater fraction of students attended camp?
   d. One of Ms. Cabral’s students says, “We were careful to choose our samples at random. Why did the two samples give us different conclusions?” How would you answer the student’s question?
Use the following information for Exercises 26–31.

Annie’s teacher starts each class with the names of all the students in a container. There are 12 girls and 6 boys in the class.

The teacher pulls out names at random to choose students to present answers. After choosing a name, the teacher sets the name aside. At the end of class, the teacher replaces all the names in the container. So, each student’s name has a chance of being chosen the next day.

26. What is the probability Annie will be the first student chosen on Monday?

27. What is the probability Annie will be the first student chosen on Tuesday?

28. What is the probability Annie will be the first student chosen on both Monday and Tuesday?

29. What is the probability the first student chosen on a given day will be a girl?

30. Suppose Annie is chosen first. What is the probability that the next student selected will be another girl?

31. Suppose the teacher plans to choose six students during one class. Would you be surprised if only two girls were chosen? Explain.
Use the following information for Exercises 32 and 33. Alyssa wants to know what students think about replacing the candy in two vending machines in the cafeteria with more healthful snacks. Alyssa obtains a list of student names, grouped by grade, with the girls listed first in each grade.

There are 300 6th graders, 300 7th graders, and 200 8th graders. Half of the students in each grade are girls.

32. Alyssa chooses 3 different students at random from the list of 800 students.
   a. What is the probability that the first choice is a girl? The second choice is a girl? The third choice is a girl?
   b. What is the probability that Alyssa chooses three girls?

33. Alyssa decides to choose one person from each grade at random.
   a. What is the probability that the 6th-grade choice is a girl?
   b. What is the probability that she chooses three girls?

For Exercises 34–38, use the table below. Alyssa chooses one girl and one boy from each grade. She asks each, “Which would you prefer, a machine with healthful snacks or a machine with candy?”

<table>
<thead>
<tr>
<th>Vending Machine Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 6</td>
</tr>
<tr>
<td>Girl</td>
</tr>
<tr>
<td>Boy</td>
</tr>
</tbody>
</table>

34. How many 6th-grade students do you think prefer a machine with healthful snacks?

35. How many students in the whole school do you think prefer a machine with healthful snacks?

36. What is the probability that a student chosen at random from the whole school is an 8th grader who prefers a machine with healthful snacks?

37. What advice would you give Alyssa’s principal about Alyssa’s data and the two vending machines? Explain.
38. Alyssa’s principal polls all 800 students and finds that 600 prefer a machine with healthful snacks.

   a. What is the probability that a student selected at random prefers a machine with healthful snacks?

   b. What is the probability that a student selected at random is a girl who prefers a machine with healthful snacks?

   c. What is the probability that a student selected at random is a boy who prefers a machine with healthful snacks?

   d. What advice would you give the principal about the data collected and the vending machines?

Extensions

39. Television stations, radio stations, and newspapers often use polls to predict the winners of elections long before the votes are cast. What factors might cause a pre-election poll to be inaccurate?

40. Political parties often write and then conduct their own pre-election polls to find out what voters think about their campaign and their candidates. How might such a poll be biased?

41. a. Polls conducted prior to presidential elections commonly use samples of about 1,000 eligible voters. Suppose there are 207 million eligible voters in the United States. About what percent of eligible voters are in a sample of 1,000?

   b. How do you think this small sample is chosen so that the results will predict the winner with reasonable accuracy? Consider which groups within the population need to be represented, such as adults 65 years or older.

Did You Know?

How do pollsters decide whom to contact? When pollsters take phone polls, they use random sampling techniques to choose voters from the total voting population. Internet polls, in most cases, exclude households without Internet access. Most online polls are also completed by people who choose to participate.