The table shows the results of a survey of 450 students. Use the table to find the probability of a student participating in each sport.

<table>
<thead>
<tr>
<th>Sport</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soccer</td>
<td>60</td>
</tr>
<tr>
<td>Tennis</td>
<td>90</td>
</tr>
<tr>
<td>Bowling</td>
<td>30</td>
</tr>
<tr>
<td>Swimming</td>
<td>120</td>
</tr>
<tr>
<td>Karate</td>
<td>50</td>
</tr>
</tbody>
</table>

a. The probability that a student is enrolled in karate is \( \frac{50}{450} = \frac{1}{9} \).

b. The probability that a student is enrolled in soccer or tennis is \( \frac{60 + 90}{450} = \frac{2}{5} \).

c. The probability that a student is enrolled in karate or bowling is \( \frac{50 + 30}{450} = \frac{2}{9} \).

d. The probability that a student is enrolled in karate or bowling or swimming is \( \frac{50 + 30 + 120}{450} = \frac{2}{5} \).

2. Make a Prediction: The school librarian recorded the types of books students checked out in a typical day. The librarian wants to make a prediction about the number of students who will check out a mystery novel. Estimate the number of students who will check out a mystery novel today.

<table>
<thead>
<tr>
<th>Type of Book</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mystery</td>
<td>100</td>
</tr>
<tr>
<td>Non-Fiction</td>
<td>200</td>
</tr>
<tr>
<td>Science</td>
<td>50</td>
</tr>
<tr>
<td>Math</td>
<td>30</td>
</tr>
</tbody>
</table>

The probability that a student will check out a mystery novel is \( \frac{100}{450} \). Therefore, the librarian can expect approximately \( \frac{100}{450} \times 450 = 100 \) students to check out a mystery novel today.

3. Find the Error: A survey of 10th grade students showed that 9 out of 20 students stated they were reading during spring break. Since there are 1300 students in 10th grade, the number of students who read is 1170. However, the survey included only 20 students.

The error is in the assumption that the 9 out of 20 students who read during spring break will apply to the entire student body. The correct calculation would be \( \frac{9}{20} \times 1300 \), which equals approximately 585 students.

4. Revenues with Problems: One letter to the editor was written by a high school mathematics teacher. Predict how many times the letter will be read.

The probability that a student will read the letter is \( \frac{1}{5} \). Therefore, the librarian can expect approximately \( \frac{1}{5} \times 450 = 90 \) students to read the letter.

5. Revenues with Problems: A survey found that 80% of students enjoy going to the movies in their free time. Out of 1500 students, predict how many students say that they do not enjoy going to the movies in their free time.

The probability that a student does not enjoy going to the movies is \( 0.20 \). Therefore, the librarian can expect approximately \( 0.20 \times 1500 = 300 \) students to say that they do not enjoy going to the movies.

6. Use the graph that shows the number of times times books were checked out.

a. About 300,000 times

b. About 900,000 times

c. About 300,000 times

7. Make a Prediction: The probability that a student reads a free novel is 0.10. Predict the number of free novels that the librarian can expect to have checked out if the library has 200 novels.

The expected number of novels checked out is \( 0.10 \times 200 = 20 \) novels.

8. Draw a line to match each situation with the appropriate equation or proportion.

a. If 27 MP3s is what percent of 238 MP3s?
   \[ \frac{27}{238} = \frac{x}{100} \]

b. 23% of 27 is what number?
   \[ 0.23 \times 27 = x \]

c. 27% of 238 MP3s downloaded music weekly. Predict how many MP3s access.
   \[ 0.27 \times 238 = x \]
Entertainment  A T.V. programming manager wants to conduct a survey to determine which reality television show is the favorite of viewers in a certain viewing area. He is considering the three samples shown. Draw an X through the two samples that would not fairly represent all of the people in the viewing area.

Sample 1  100 people that are trying out for a reality show
Sample 2  100 students at your middle school
Sample 3  Every 100th person at a shopping mall

Explain why the two samples that you crossed out do not fairly represent all of the people in the viewing area? Explain.
Biased and Unbiased Samples

To get valid results, a sample must be chosen very carefully. An unbiased sample is selected so that it accurately represents the entire population. Two ways to pick an unbiased sample are listed below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Random Sample</td>
<td>Each item or person in the population is as likely to be chosen as any other.</td>
<td>Each student’s name is written on a piece of paper. The names are placed in a bowl, and names are picked without looking.</td>
</tr>
<tr>
<td>Systematic Random Sample</td>
<td>The items or people are selected according to a specific time or item interval.</td>
<td>Every 20th person is chosen from an alphabetical list of all students attending a school.</td>
</tr>
</tbody>
</table>

MUST KNOW DESCRIPTIONS!!

In a biased sample, one or more parts of the population are favored over others. Two ways to pick a biased sample are listed below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience Sample</td>
<td>A convenience sample consists of members of a population that are easily accessed.</td>
<td>To represent all the students attending a school, the principal surveys the students in one math class.</td>
</tr>
<tr>
<td>Voluntary Response Sample</td>
<td>A voluntary response sample involves only those who want to participate in the sampling.</td>
<td>Students at a school who wish to express their opinions complete an online survey.</td>
</tr>
</tbody>
</table>

Unbiased - random; fair; not influenced

biased - prejudice; unfair; influenced

page 580 - refer to chart
Examples

Determine whether the conclusion is valid. Justify your answer.

1. A random sample of students at a middle school shows that 10 students prefer listening to rock, 15 students prefer listening to hip hop, and 25 students prefer no music while they exercise. It can be concluded that half the students prefer no music while they exercise.

Unbiased, Valid, Simple random sample

This is a simple random sample. So, the sample is unbiased and the conclusion is valid.
Determine whether each conclusion is valid. Justify your answer.

2. Every tenth person who walks into a department store is surveyed to determine his or her music preference. Out of 150 customers, 70 stated that they prefer rock music. The manager concludes that about half of all customers prefer rock music.

Unbiased, valid, systematic random sample

Since the population is every tenth customer of a department store, the sample is an unbiased, systematic random sample. The conclusion is valid.
3. The customers of a music store are surveyed to determine their favorite leisure time activity. The results are shown in the graph. The store manager concludes that most people prefer to listen to music in their leisure time.

Leisure Time Activities

- Listening to Music: 85%
- Playing Sports: 6%
- Other: 9%

Biased, not valid, convenience sample

The customers of a music store probably like to listen to music in their leisure time. The sample is a biased, convenience sample since all of the people surveyed are in one specific location. The conclusion is not valid.
a. A radio station asks its listeners to indicate their preference for one of two candidates in an upcoming election. Seventy-two percent of the listeners who responded preferred candidate A, so the radio station announced that candidate A would win the election. Is the conclusion valid? Justify your answer.

**Biased, not valid, voluntary response sample**

*The conclusion is not valid. The population is restricted to listeners of a radio station and it is a voluntary response sample.*
A valid sampling method uses unbiased samples. If a sampling method is valid, you can make generalizations about the population.

**Example**

4. A store sells 3 types of pants: jeans, capris, and cargos. The store workers survey 50 customers at random about their favorite type of pants. The survey responses are indicated at the right. If 450 pairs of pants are ordered, how many should be jeans?

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeans</td>
<td>25</td>
</tr>
<tr>
<td>Capris</td>
<td>15</td>
</tr>
<tr>
<td>Cargos</td>
<td>10</td>
</tr>
</tbody>
</table>

Unbiased, valid, simple random sample

\[
\frac{25}{50} = \frac{n}{450} \quad n = 225 \text{ jeans}
\]
1. Zach is trying to decide which of three golf courses is the best. He randomly surveyed people at a sports store and recorded the results in the table. Is the sample method valid? If so, suppose Zach surveyed 150 more people. How many people would be expected to vote for Rolling Meadows?  (Example 4)

This is a simple random sample. So, the sample is valid; ________________
42 people. ________________

2. To find how much money the average American family spends to cool their home, 100 Alaskan families are surveyed at random. Of the families, 85 said that they spend less than $75 per month on cooling. The researcher concluded that the average American family spends less than $75 on cooling per month. Is the conclusion valid? Explain.  (Examples 1–3)

The conclusion is not valid. This is a biased, ________________
convenience sample, since people in other states ________________
would spend much more than those in Alaska.
Using Sampling to Predict

Describe each sample.

1. To evaluate the defect rate of its memory chips, an integrated circuit manufacturer tests every 100th chip off the production line.

2. Students who wish to represent the school at a school board meeting are asked to stop by the office after lunch.

3. To determine if the class understood the homework assignment, the math teacher checks the top 3 papers in the pile of collected homework.

4. To determine the representatives to the recess activities meeting, 2 students are selected at random from each homeroom.

5. A member of the cafeteria staff asks every fifth student leaving the cafeteria to rank 5 vegetables from most favorite to least favorite.

6. One bead for every member of the school orchestra is placed in a bag. All but 2 of the beads are white. Each member draws a bead from the bag, and the members who pick the non-white beads will represent the orchestra.

7. A real estate agent surveys people about their housing preferences at an open house for a luxury townhouse.

8. To determine the most popular children's programs, a television station asks parents to call in and complete a phone survey.

9. Two teachers from each school in the district are chosen at random to fill out a survey on classroom behavior.

10. Airline boarding passes are marked with red stars at random to decide which passengers should have their carry-on luggage inspected.

11. To determine how often people eat out, every tenth person entering a fast-food restaurant is surveyed.
8-7 Practice: Skills

Using Sampling to Predict

Describe each sample.

1. To evaluate the defect rate of its memory chips, an integrated circuit manufacturer tests every 100th chip off the production line. This is an unbiased, systematic random sample.

2. Students who wish to represent the school at a school board meeting are asked to stop by the office after lunch. This is a biased sample since only students with strong opinions are likely to volunteer. This is a voluntary response sample.

3. To determine if the class understood the homework assignment, the math teacher checks the top 3 papers in the pile of collected homework. This is a biased sample, since only papers turned in and on top of the pile are represented. This is a convenience sample.

4. To determine the representatives to the recess activities meeting, 2 students are selected at random from each homeroom. This is an unbiased, stratified random sample.

5. A member of the cafeteria staff asks every fifth student leaving the cafeteria to rank 5 vegetables from most favorite to least favorite. This is an unbiased, systematic random sample.

6. One bead for every member of the school orchestra is placed in a bag. All but 2 of the beads are white. Each member draws a bead from the bag, and the members who pick the non-white beads will represent the orchestra. This is an unbiased, simple random sample.

7. A real estate agent surveys people about their housing preferences at an open house for a luxury townhouse. This is a biased sample since the people surveyed probably prefer townhouses. This is a convenience sample.

8. To determine the most popular children's programs, a television station asks parents to call in and complete a phone survey. This is a biased sample, since only parents with strong opinions are likely to call. This is a voluntary response sample.

9. Two teachers from each school in the district are chosen at random to fill out a survey on classroom behavior. This is an unbiased, stratified random sample.

10. Airline boarding passes are marked with red stars at random to decide which passengers should have their carry-on luggage inspected. This is an unbiased, simple random sample.

11. To determine how often people eat out, every tenth person entering a fast-food restaurant is surveyed. This is a biased sample, since the people surveyed are eating out. This is a convenience sample.