7.5 Statistics

* Random Sampling
* Inferences from Random Data
1. George put some cards into a basket. Then, he drew 3 cards out of the basket. Is this a random sample of the cards in the basket? Why or why not?

**Explanation:**

1. In a random sample, every person or item has an equal chance of being chosen. Since every card had an equal chance being picked, in this case, it is a random sample.

2. Jacob wanted to know what the most popular sneaker brand was of his classmates. His class had 30 students. To save time, he asked 10 boys the brand of sneakers that they were wearing. Of the students surveyed; Nike was the most popular sneaker brand.

Explain 2 ways Jacob’s survey could have been more representative of his class’s favorite sneaker brand.

**Explanation:**

2. There are a number of ways to do this. The most common answers are:

   a) Survey girls as well.
   b) Survey more students.
   c) Ask students all of the sneaker brands that they own.
Lesson

1) Michael is trying to determine the best location to have his pizza shop. There are 4 different districts in his city (business, garment, government, and harbor). Michael took a week to observe where people tend to gather in the business and harbor districts. Michael then decided to have his shop in the harbor district where he saw the most people gather.

What changes to Michael’s technique would have gave him a better understanding of where his store would be most successful?

Survey all 4 districts
(Observing)
Survey people to see if they like pizza.

2) Lewis is trying to determine the bus stop location that the most people get on the bus from. He surveys every third student coming off the bus. He asks them where they get on the bus.

What would have been an improvement in Lewis research?

a. Ask all students what they had for breakfast.
   b. Survey all students on the bus.
   c. Ask students how long they have been riding the bus.

3) Kevin threw some red pieces of paper into the air, and then collected 2 pieces that landed on the floor.

Is this a random sample of the red pieces of paper? Yes
Matching

1. Jeffery wants to launch a film magazine. He wants to know the best place to sell the magazine in the city. He surveyed four city blocks (P, Q, R, S street). He found that youngsters living on street P and R love to read about film stars. He decided to sell the magazine only on street P because the people looked well dressed. What would have gave him a better understanding of which part of the city should be chosen?

   a. Look at the number of successful restaurants in those areas.
   b. No.
   c. Look at sales of magazines in those areas.
   d. Survey all people.

2. George put some red, yellow, and green shirts into a bag. He took out 2 yellow shirts from a bag while looking for them. Is this a random sample of the shirts in the bag?

3. William wants to find out where the most people buy burgers. He surveys every third person from street and asks them where they get burgers from? What would have been an improvement in William's experiment?

4. Jamie wants to open a vegetarian restaurant. He wants to know in which area he should establish the restaurant. He surveyed and found that there are four choices of location in the city A, B, C, D. He found that middle age people and old people like vegetarian food most. These populations are found mostly in part A and B of the city. He decides to open his restaurant in part B. How could he have improved his choice of location?
Practice

1. Harry collected green balls in a bag. He drew two balls, of the five balls, out of the bag. Is this a random sample of the green balls in the bag?

Yes

2. Daisy wants to find out where the greatest number of people buy fast food for lunch. He surveys every fourth person on a random street and asks them where they get food for lunch regularly?

What would have been an improvement in Daisy's experiment?

a. Ask people their favorite lunch food.

b. Survey all people in the area.

c. Ask people where they get breakfast.

3. Jack is trying to determine the best location to sell hot dogs. There are 4 different licensed locations in the city (on the street, downtown, near the garden, and in the school canteen). Jack observed that many people tend to visit downtown and the garden. Jack decided to sell hot dogs in the downtown area where he saw that the most people gather.

What changes to Jack technique would have giving him a better understanding of where he would be the most successful selling hot dogs?

Survey/observe all four locations

Survey people to see if they like hot dogs.

4. Kerry collected shells from a sea shore in a box. He takes out a handful of shells from the box. Is this a random sample of shells in the box?

Yes.
5. There are four doctors in the city. Their offices are located in four different parts of the city (South Street, Downtown, Outskirts Alley, and West Street). Kevin is trying to figure out which doctor has the most patients. He observed that the Downtown and West Street areas have larger populations. He concurred that the doctors in those areas have more patients. After comparing those two areas, he decided that the West Street doctor had the most patients because the area had the most traffic.

What changes to Kevin technique would have giving him a better understanding of which doctor has most patients?

Observe all four parts of the city.
Survey the number of people visiting doctors offices.

6. Drew tries to predict which restaurant will have the least amount of business during Christmas season. There are three restaurants in city. Two are on the outskirts of the city and one is in the city. He learned that two hotels situated on the outskirts are fully booked because one has a Christmas show and the other restaurant has a huge indoor pool. From this information he inferred that the restaurant in the city will have the least amount of business during the Christmas season.

What would have been an improvement in Drew’s experiment?

a. Ask people at the restaurants if they like fast food.
b. Survey all people to see which December holiday they celebrate.
c. Look at the past Holiday performance of the restaurants.

7. Terry had white and red marbles in a container. He takes out 4 marbles, without looking in the container. Is this a random sample of marbles in a container?

Yes.
8. Fred is releasing his new album of jazz music. He can only release the album in one store. He wants to know where his release would be the most successful in the city. He observed that the downtown area people and college students love jazz music the most. He then decided to release the album in downtown store because he felt college students might not be able to afford the album.

What changes to Fred technique would have giving him a better understanding of where his release would be the most successful?

- Survey people from both areas.
- Observe more areas.

9. Jeffery is comic writer. He wants to write new comics for children. He wants to write comics that are specific for his readers. He decides to write the comic specifically for one local elementary school. There are five local elementary schools he is considering. Jeffery wants to write the comic for the most people possible. Which is the best question to ask schools to determine which elementary school has the most students?

a. How many school buses drop off students every morning at your school?

b. How many photo copiers does your school have?

- How many student chairs are in your school?

d. How much milk is consumed at your school every year?

10. George put some assorted color shirts into a bag. He looks in the bag and removes the blue shirts from the bag. Is this a random sample of the shirts in the bag? No. No peeking.
Making Inferences from Random Data

Lesson 1 Data Problem:

John has to complete a research project on the ape population in Spain. He is trying to estimate the size and population of apes. He randomly catches 37 apes and marks them with paint. He releases the apes into jungle. The following year he observes 250 apes and he found that 10 were marked with the paint that he used.

Find out the best estimate for the size of the ape population?

Explanation:

The ratio of marked apes to total apes should be about the same in both the sample population and the overall population.

Set up a proportion.

\[
\frac{\text{number of marked Apes counted}}{\text{total number of Apes counted}} = \frac{\text{total number of marked Apes}}{\text{estimate of Ape population}}
\]

Plug in the numbers you know and solve for the Ape population, \( p \).

\[
\frac{10}{250} = \frac{37}{p}
\]

\[10p = 37 \times 250 \text{ (find the cross products)}\]

\[10p = 9,250 \text{ divide both sides by 10.}\]

\[p = 925 \text{ (approx)}\]

The best estimate for the ape population is 925.
Lesson

1) A famous television channel put tags on 58 alligators and released them. Later, they catch 260 alligators; among those alligator, 50 were tagged. Calculate the best estimate for the alligator population?

\[
\frac{50}{260} = \frac{58}{p} \Rightarrow 50p = 58(260) \Rightarrow \frac{50p}{50} = \frac{15080}{50} \\
p \approx 301.6 \text{ estimated Alligator population.}
\]

2) Management wants to open a cafeteria in the office building. So they collected data from two random samples of 100 employees regarding employees' office lunch preference? Make at least two inferences based on the results.

<table>
<thead>
<tr>
<th>Sample Group</th>
<th>Corn Dog</th>
<th>Philly Cheese steak</th>
<th>Reuben Sandwich</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>56</td>
<td>35</td>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>78</td>
<td>12</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Employees prefer Corn Dogs.
2. Reuben sandwiches are least popular.
3. Employees prefer Philly Cheese Steak over Reuben sandwiches.

3) A computer tracking chip company wants to test their chips. They marked 32 birds by attaching computer chips to their legs. Later on, they catch 440 birds, 28 of which are marked with computer chips attached to them. They provided this data to animal welfare authorities to estimate the bird population. To the nearest whole number, what is the best estimate of the bird population?

\[
\frac{\text{# marked counted}}{\text{total # counted}} = \frac{\text{total # marked}}{\text{estimate population}(x)} \\
\frac{28}{440} = \frac{32}{x} \\
x = \frac{32(440)}{28} \\
x \approx 503 \text{ bird population}
\]
Matching

1. Veterinary doctors marked 30 deer and released them. Later on, they counted 150 deer, 12 of which had marks. To the nearest whole number, what is the best estimate for the deer population?

2. Gregory collected two random samples of 100 Woman regarding woman's color bag preference for his new bag business. Make an inference from the data.

<table>
<thead>
<tr>
<th>People Sample</th>
<th>Red Bag</th>
<th>Black Bag</th>
<th>Blue Bag</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>34</td>
<td>50</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>24</td>
<td>54</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

3. Herald is keeping track of eagles. To do so, he put tags on 25 eagles and released them. Later, he catches 120 eagles; 16 eagles were tagged. Find the best estimate for the Eagle population?

4. Jenny owns a footwear business. She wants to expand her business, so she collected two random samples of 100 men regarding men’s footwear preference? Make an inference based on this data.

<table>
<thead>
<tr>
<th>Student Sample</th>
<th>shoes</th>
<th>slippers</th>
<th>sandals</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>20</td>
<td>20</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>25</td>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
1. Scientists in the jungle want to find the best estimate for the lion population. They tagged and released 20 lions as part of a research project. Later, they found 160 lions, 8 of which were tagged. Find the best estimate of population?

\[
\frac{\frac{8}{160}}{x} = \frac{\frac{80}{x}}{\frac{8}{160}} \quad \text{or} \quad 8x = 3200
\]

\[
x = \frac{3200}{8} = 400 \text{ lions}
\]

2. Ronald works in an Ornithology department. Students asked him to find out the best estimate of the local bird population. So he tied a belt around the legs of 40 birds. A few days later, he observed 520 birds, 34 of which had belts. To the nearest whole number, what is the best estimate for the bird population?

\[
\frac{\frac{34}{520}}{x} = \frac{\frac{40}{x}}{\frac{34}{520}} \quad \text{or} \quad 34x = 40(520)
\]

\[
x = \frac{40(520)}{34} \approx 612 \text{ birds}
\]

3. Henry has a stationery shop in school. He surveyed and collected random samples of 100 students regarding student's pen preference. Make at least two inferences based on the results.

<table>
<thead>
<tr>
<th>Student Sample</th>
<th>Crystal Pens</th>
<th>Metal Pens</th>
<th>Plastic Pens</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>32</td>
<td>48</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>18</td>
<td>67</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Student's prefer metal pens.
2. Student's prefer plastic pens the least.
3. Student's prefer crystal pens over plastic pens.
4. Sam is a school leader. She wants to decide whether makeup should be allowed in school or not? She collected random samples of 100 females regarding make up preference. Make at least two inferences based on the results.

<table>
<thead>
<tr>
<th>Student Sample</th>
<th>Mascara</th>
<th>Lipstick</th>
<th>Eye liner</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>46</td>
<td>26</td>
<td>28</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>60</td>
<td>17</td>
<td>23</td>
<td>100</td>
</tr>
</tbody>
</table>

- Females prefer mascara.
- Females prefer eye liner over lipstick.
- Females prefer lipstick the least.

5. Farmers marked 45 cows and released them. The next day they counted 150 cows, 15 of which had marks. Find the best estimate for the cow population in village?

\[
\frac{15}{150} = \frac{45}{x} \quad \Rightarrow \quad \frac{15x}{15} = \frac{6750}{15} \quad \Rightarrow \quad x = 450
\]

6. The animal department wants to estimate baboon population. So they paint 50 baboons with a mark. These baboons were then released into the jungle. After two months, 300 baboons were caught. Among these baboons, 25 were marked. To the nearest whole number, what is the best estimate for the baboon population?

\[
\frac{25}{300} = \frac{50}{x} \quad \Rightarrow \quad \frac{25x}{25} = \frac{15000}{25} \quad \Rightarrow \quad x = 600
\]
7. The government of Mexico declared blue sharks an endangered species. They put tags on 36 blue sharks and released them. Later, they corral 130 blue sharks; among those blue sharks, 20 were tagged. Find the best estimate for the blue shark population:

\[
\frac{20}{130} = \frac{36}{x} \\
30x = 36(130) \\
\frac{30x}{30} = \frac{4680}{30} \\
x = 234
\]

8. The local food surveyors collected data of two random samples of 100 children regarding their food preference? Make at least two inferences based on the results.

<table>
<thead>
<tr>
<th>Student Sample</th>
<th>Apples</th>
<th>Banana</th>
<th>Grapes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>62</td>
<td>20</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>68</td>
<td>18</td>
<td>14</td>
<td>100</td>
</tr>
</tbody>
</table>

Children prefer Apples.
Children like Grapes least.
Children prefer Bananas over Grapes.

9. Snake charmers want to estimate the population of a particular species of cape cobra. They mark 20 cape cobras with a radioactive tag. After few months they catch 190 cape cobras, 17 of which had marks. What is the best estimate for the cape cobra population?

\[
\frac{17}{190} = \frac{20}{x} \\
17x = 20(190) \\
\frac{17x}{17} = \frac{3800}{17} \\
x = 223.5, \approx 224 \text{ Cape Cobras}
\]
10. Andrew is planning what to buy for a garments store in the downtown area. He collected two random samples of 100 men regarding their men’s wear preference. Make at least two inferences based on the results.

<table>
<thead>
<tr>
<th>Student Sample</th>
<th>Jeans</th>
<th>Pants</th>
<th>Shorts</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>78</td>
<td>10</td>
<td>12</td>
<td>100</td>
</tr>
<tr>
<td>#2</td>
<td>64</td>
<td>22</td>
<td>14</td>
<td>100</td>
</tr>
</tbody>
</table>

*Men prefer jeans.*

*Men do not have a strong preference between pants and shorts.*