

Chapter 13 - Exploring the World of Statistics

Objective: I can distinguish populations, samples, data types, and sampling methods.

Use precise statistical vocabulary and explain any likely bias.

1. A school has 1,200 students and surveys 80. Identify the population and sample.	2. In that survey, 62% prefer later start times. Is 62% a parameter or a statistic?
3. Classify shoe size and favorite subject as quantitative or categorical.	4. Classify number of siblings and height as discrete or continuous.
5. A school surveys only basketball-team members to estimate student exercise time. Identify the method and likely bias.	6. Describe a valid simple random sample of 100 students from the school of 1,200.

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Objective: I can calculate and interpret measures of center and spread.

Show ordered data and arithmetic clearly.

7. Find the mean of 6, 8, 8, 10, 13.	8. For 6, 8, 8, 10, 13, find the median, mode, and range.
9. Find the median of 12, 15, 9, 18, 11, 13.	10. The mean of 12, 16, 20, 24, and one missing value is 18. Find the missing value.
11. The mean of 4, 7, 9, 10, x is 8. Find x.	12. For 5, 6, 6, 7, 8, compare the mean and median before and after adding 30. Which is more resistant?

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Objective: I can find quartiles, interquartile range, five-number summaries, and outliers.

Use the median-of-halves convention and show all fences.

13. For 2, 4, 5, 7, 9, 10, 12, 15, find Q_1, median, Q_3, and IQR.	14. Write the five-number summary for the data in Question 13.
15. If $Q_1 = 10$ and $Q_3 = 22$, identify outliers among 5, 12, 18, 22, 41.	16. For 3, 5, 6, 8, 9, 11, 12, 20, use the $1.5(IQR)$ rule to decide whether 20 is an outlier.
17. Describe how adding 4 to every value affects the mean, median, quartiles, range, and IQR.	18. A data set has median 7 and IQR 4. Find the new median and IQR if every value is multiplied by 3.

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Objective: I can calculate and interpret mean absolute deviation, variance, standard deviation, and standard scores.

Use population variance when the full data set is given.

19. Find the mean absolute deviation of 2, 4, 6, 8, 10.	20. Find the population variance and standard deviation of 2, 4, 6. Give exact and approximate results.
21. Find the population standard deviation of 5, 5, 5, 5.	22. Sets A and B are 10, 10, 10, 10, 10 and 6, 8, 10, 12, 14. Compare their means and variability.
23. A score is 78, the mean is 70, and the standard deviation is 4. Find and interpret the z-score.	24. Find the value with $z = -1.5$ when the mean is 50 and standard deviation is 6.

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Objective: I can extract measures of center from frequency data and calculate weighted means.

Use frequency as a weight and divide by total frequency.

25. For $\frac{x}{f} \begin{array}{c cccc} 1 & 2 & 3 & 4 \\ \hline 2 & 5 & 2 & 1 \end{array}$, find the mean.	26. For the frequency data in Question 25, find the median.
27. For the frequency data in Question 25, find the mode.	28. Tests are 80 with weight 60%, quizzes 90 with 25%, and homework 100 with 15%. Find the course grade.
29. A class of 20 has mean 72 and a class of 30 has mean 84. Find the combined mean.	30. Scores 70, 80, 90, 100 have frequencies 1, 3, 4, 2. Find the mean.

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Objective: I can calculate joint, marginal, and conditional relative frequencies and assess association.

Use the appropriate row, column, or overall total.

31. Use <table><tr><td></td><td><i>S</i></td><td><i>B</i></td><td><i>T</i></td></tr><tr><td><i>G9</i></td><td>18</td><td>12</td><td>30</td></tr><tr><td><i>G10</i></td><td>14</td><td>16</td><td>30</td></tr><tr><td><i>T</i></td><td>32</td><td>28</td><td>60</td></tr></table> Find the joint relative frequency of Grade 9 and soccer.		<i>S</i>	<i>B</i>	<i>T</i>	<i>G9</i>	18	12	30	<i>G10</i>	14	16	30	<i>T</i>	32	28	60	32. Using the same table, find the percent of Grade 10 students who prefer basketball.
	<i>S</i>	<i>B</i>	<i>T</i>														
<i>G9</i>	18	12	30														
<i>G10</i>	14	16	30														
<i>T</i>	32	28	60														
33. Using the same table, compare the conditional soccer percentages for Grade 9 and Grade 10.	34. Use <table><tr><td></td><td><i>P</i></td><td><i>N</i></td><td><i>T</i></td></tr><tr><td><i>A</i></td><td>36</td><td>4</td><td>40</td></tr><tr><td><i>NA</i></td><td>24</td><td>16</td><td>40</td></tr><tr><td><i>T</i></td><td>60</td><td>20</td><td>80</td></tr></table> Find pass rates for attendees and nonattendees.		<i>P</i>	<i>N</i>	<i>T</i>	<i>A</i>	36	4	40	<i>NA</i>	24	16	40	<i>T</i>	60	20	80
	<i>P</i>	<i>N</i>	<i>T</i>														
<i>A</i>	36	4	40														
<i>NA</i>	24	16	40														
<i>T</i>	60	20	80														
35. Using the tutoring table, determine whether attendance is associated with passing. Explain without claiming causation.	36. Using the tutoring table, find the marginal relative frequency of not passing.																

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Objective: I can interpret algebraic prediction models, correlation, residuals, and statistical errors.

Use numerical evidence and interpret every answer in context.

37. Find the exact linear rule for $\frac{x}{y} \begin{array}{c c} 1 & 2 & 3 & 4 \\ \hline 3 & 5 & 7 & 9 \end{array}$.	38. A score model is $S = 6h + 52$. Interpret the slope when h is study hours.
39. For $S = 6h + 52$, interpret the intercept.	40. For $S = 6h + 52$, find the residual when $h = 5$ and the actual score is 83.
41. Classify the linear association when $r = 0.91$.	42. Classify the association when $r = -0.18$ and explain why it does not prove causation.
43. At $x = 4$, the actual value is 30. Compare models $A = 5x + 9$ and $B = 6x + 4$ using absolute residuals.	44. In 10 observations, a value was corrected from 42 to 72. By how much does the mean change?

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Objective: I can correct statistical reasoning, design representative samples, and transform summary measures.

Give a concise calculation and a statistical justification.

45. In 11 ordered observations, only the largest value changes and remains largest. Explain the effect on the median.	46. Class A has 10 students with mean 80; Class B has 30 with mean 90. Correct the claim that the combined mean is 85.
47. A public online survey includes only volunteers. Identify the bias and explain the concern.	48. A school is 60% Grades 9-10 and 40% Grades 11-12. Design a proportional stratified sample of 100.
49. Honors challenge: Sorted values are 12, 18, 18, a, 32 with mean 20. Find a and verify the median and mode.	50. Honors challenge: A data set has mean 14 and population standard deviation 3. For $y = 2x - 5$, find the new mean and standard deviation.

Other topics for review:

- A parameter describes a population; a statistic describes a sample.
- Median and IQR are more resistant to extreme values than mean and standard deviation.
- Weighted means must account for unequal frequencies, weights, or group sizes.
- Conditional relative frequencies are calculated within the relevant subgroup.
- Correlation and regression describe association but do not prove causation.