MATH 110: Descriptive Statistics — Worksheet

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Learning Objectives

- Calculate the mean, median, mode, and range of a data set
- Compute sample variance and standard deviation
- Construct quartiles, the IQR, and identify outliers
- Describe the shape, center, and spread of a distribution

Simplify each expression completely. Show all steps and circle your final answer.

Box-and-Whisker Plot

1. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

Answer: _____

2. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

Answer: _____

3. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

Answer: _____

Empirical rule (68-95-99.7)

4. Scores are normally distributed. What percent of scores fall within 3 standard deviation(s) of the mean?

Answer: _____

5. Scores are normally distributed. What percent of scores fall within 2 standard deviation(s) of the mean?

Answer: _____

6. Scores are normally distributed. What percent of scores fall within 2 standard deviation(s) of the mean?

Answer: _____

Quartiles and IQR

7. Find Q1, Q3, and the IQR:

Answer: _____

8. Find Q1, Q3, and the IQR:

Answer: _____

9. Find Q1, Q3, and the IQR:

Answer: _____

Mean of a data set

10. Find the mean of the data set:

Answer: _____

11. Find the mean of the data set:

Answer: _____

12. Find the mean of the data set:

Answer: _____

Median of a data set

13. Find the median of the data set:

Answer: _____

14. Find the median of the data set:

Answer: _____

15. Find the median of the data set:

Answer: _____

Mode of a data set

16. Find the mode:

Answer: _____

17. Find the mode:

Answer: _____

18. Find the mode:

Answer: _____

Outlier detection (1.5xIQR rule)

19. Using the 1.5xIQR rule, determine if the value is an outlier:

Answer: _____

20. Using the 1.5xIQR rule, determine if the value is an outlier:

Answer: _____

21. Using the 1.5xIQR rule, determine if the value is an outlier:

Answer: _____

Range

22. Find the range:

Answer: _____

23. Find the range:

Answer: _____

24. Find the range:

Answer: _____

Sample variance and standard deviation

25. Find the sample variance and standard deviation (round to 2 decimal places):

Answer: _____

26. Find the sample variance and standard deviation (round to 2 decimal places):

Answer: _____

27. Find the sample variance and standard deviation (round to 2 decimal places):

Answer: _____

Z-score

28. Find the z-score and interpret it:

Answer: _____

29. Find the z-score and interpret it:

Answer: _____

30. Find the z-score and interpret it:

Answer: _____

Answer Key & Solutions

Topics: Sample variance and standard deviation, Z-score, Range, Empirical rule (68-95-99.7), Box-and-Whisker Plot, Median of a data set, Quartiles and IQR, Outlier detection (1.5xIQR rule), Mode of a data set, Mean of a data set. All answers verified by independent computation.

Solutions

Box-and-Whisker Plot

1. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

    - Sort the data in ascending order: [14, 16, 21, 24, 25, 28, 38, 41, 50, 56, 57, 60].
    - Min = 14, Max = 60.
    - Median = 33.0.
    - Q1 (median of lower half) = 22.5; Q3 (median of upper half) = 53.0.
    - IQR = Q3 - Q1 = 30.5.
    - Draw the box from Q1 to Q3 with a line at the median; extend whiskers to Min and Max (see plot).

Answer: _____

2. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

    - Sort the data in ascending order: [10, 14, 19, 21, 30, 36, 41, 49, 56, 59].
    - Min = 10, Max = 59.
    - Median = 33.0.
    - Q1 (median of lower half) = 19.0; Q3 (median of upper half) = 49.0.
    - IQR = Q3 - Q1 = 30.0.
    - Draw the box from Q1 to Q3 with a line at the median; extend whiskers to Min and Max (see plot).

Answer: _____

3. Find the five-number summary (Min, Q1, Median, Q3, Max) for the data set below, then construct a box-and-whisker plot.

    - Sort the data in ascending order: [10, 13, 25, 28, 30, 32, 36, 39, 41, 44, 56, 59].
    - Min = 10, Max = 59.
    - Median = 34.0.
    - Q1 (median of lower half) = 26.5; Q3 (median of upper half) = 42.5.
    - IQR = Q3 - Q1 = 16.0.

- Draw the box from Q1 to Q3 with a line at the median; extend whiskers to Min and Max (see plot).

Answer: _____

Empirical rule (68-95-99.7)

4. Scores are normally distributed. What percent of scores fall within 3 standard deviation(s) of the mean?

   - Lower bound: 61 - 3(8) = 37.
   - Upper bound: 61 + 3(8) = 85.
   - Empirical rule: {answer}% of data falls within {k} standard deviation(s) of the mean.

Answer: _____

5. Scores are normally distributed. What percent of scores fall within 2 standard deviation(s) of the mean?

   - Lower bound: 79 - 2(7) = 65.
   - Upper bound: 79 + 2(7) = 93.
   - Empirical rule: {answer}% of data falls within {k} standard deviation(s) of the mean.

Answer: _____

6. Scores are normally distributed. What percent of scores fall within 2 standard deviation(s) of the mean?

   - Lower bound: 74 - 2(11) = 52.
   - Upper bound: 74 + 2(11) = 96.
   - Empirical rule: {answer}% of data falls within {k} standard deviation(s) of the mean.

Answer: _____

Quartiles and IQR

7. Find Q1, Q3, and the IQR:

   - Sort: [7, 18, 20, 26, 28, 29, 32, 38]. n = 8.
   - Lower half: [7, 18, 20, 26] -> Q1 = 19.0.
   - Upper half: [28, 29, 32, 38] -> Q3 = 30.5.
   - IQR = Q3 - Q1 = 30.5 - 19.0 = 11.5.

Answer: _____

8. Find Q1, Q3, and the IQR:

   - Sort: [1, 6, 8, 14, 27, 37]. n = 6.

- Lower half: [1, 6, 8] -> Q1 = 6.0.
- Upper half: [14, 27, 37] -> Q3 = 27.0.
- IQR = Q3 - Q1 = 27.0 - 6.0 = 21.0.

Answer: _____

9. Find Q1, Q3, and the IQR:

- Sort: [5, 11, 12, 20, 21, 27, 29, 33]. n = 8.
- Lower half: [5, 11, 12, 20] -> Q1 = 11.5.
- Upper half: [21, 27, 29, 33] -> Q3 = 28.0.
- IQR = Q3 - Q1 = 28.0 - 11.5 = 16.5.

Answer: _____

Mean of a data set

10. Find the mean of the data set:

- Add all 7 values: 129.
- Divide by n = {n}: {sum_values} ÷ {n} = {answer}.

Answer: _____

11. Find the mean of the data set:

- Add all 5 values: 93.
- Divide by n = {n}: {sum_values} ÷ {n} = {answer}.

Answer: _____

12. Find the mean of the data set:

- Add all 8 values: 147.
- Divide by n = {n}: {sum_values} ÷ {n} = {answer}.

Answer: _____

Median of a data set

13. Find the median of the data set:

- Sort the data: [4, 6, 22, 24, 31].
- n = 5 — odd — take the middle value.
- Median = {answer}.

Answer: _____

14. Find the median of the data set:

- Sort the data: [6, 16, 17, 37, 38].
- n = 5 — odd — take the middle value.

- Median = {answer}.

Answer: _____

15. Find the median of the data set:

- Sort the data: [2, 10, 21, 24, 34].
- n = 5 — odd — take the middle value.
- Median = {answer}.

Answer: _____

Mode of a data set

16. Find the mode:

- Tally each value's frequency.
- 11 appears 3 times — more than any other value.
- Mode = {answer}.

Answer: _____

17. Find the mode:

- Tally each value's frequency.
- 20 appears 2 times — more than any other value.
- Mode = {answer}.

Answer: _____

18. Find the mode:

- Tally each value's frequency.
- 6 appears 2 times — more than any other value.
- Mode = {answer}.

Answer: _____

Outlier detection (1.5xIQR rule)

19. Using the 1.5xIQR rule, determine if the value is an outlier:

- Upper fence = Q3 + 1.5 x IQR = 24 + 13.5 = 37.5.
- Lower fence = Q1 - 1.5 x IQR = 15 - 13.5 = 1.5.
- 34 is within [1.5, 37.5] -> 34 is NOT an outlier.

Answer: _____

20. Using the 1.5xIQR rule, determine if the value is an outlier:

- Upper fence = Q3 + 1.5 x IQR = 22 + 16.5 = 38.5.
- Lower fence = Q1 - 1.5 x IQR = 11 - 16.5 = -5.5.

- 37 is within [-5.5, 38.5] -> 37 is NOT an outlier.

Answer: _____

21. Using the 1.5xIQR rule, determine if the value is an outlier:

- Upper fence = Q3 + 1.5 x IQR = 27 + 12.0 = 39.0.
- Lower fence = Q1 - 1.5 x IQR = 19 - 12.0 = 7.0.
- 38 is within [7.0, 39.0] -> 38 is NOT an outlier.

Answer: _____

Range

22. Find the range:

- Range = max − min.
- max = 50, min = 1.
- Range = {max_val} − {min_val} = {answer}.

Answer: _____

23. Find the range:

- Range = max − min.
- max = 49, min = 4.
- Range = {max_val} − {min_val} = {answer}.

Answer: _____

24. Find the range:

- Range = max − min.
- max = 49, min = 15.
- Range = {max_val} − {min_val} = {answer}.

Answer: _____

Sample variance and standard deviation

25. Find the sample variance and standard deviation (round to 2 decimal places):

- Mean = 8.7143.
- Squared deviations: $(11-8.71)^2=5.22$, $(6-8.71)^2=7.37$, $(8-8.71)^2=0.51$, $(12-8.71)^2=10.8$, $(2-8.71)^2=45.08$, $(4-8.71)^2=22.22$, $(18-8.71)^2=86.22$.
- s^2 = sum ÷ (n−1) = 177.4286 ÷ 6 = 29.57.
- $s = \sqrt{29.57} \approx 5.44$.

Answer: _____

26. Find the sample variance and standard deviation (round to 2 decimal places):

- Mean = 14.6667.
- Squared deviations: $(16-14.67)^2=1.78$, $(8-14.67)^2=44.44$, $(19-14.67)^2=18.78$, $(13-14.67)^2=2.78$, $(20-14.67)^2=28.44$, $(12-14.67)^2=7.11$.
- s^2 = sum ÷ (n−1) = 103.3333 ÷ 5 = 20.67.
- s = √20.67 ≈ 4.55.

Answer: _____

27. Find the sample variance and standard deviation (round to 2 decimal places):

- Mean = 12.75.
- Squared deviations: $(17-12.75)^2=18.06$, $(2-12.75)^2=115.56$, $(14-12.75)^2=1.56$, $(18-12.75)^2=27.56$.
- s^2 = sum ÷ (n−1) = 162.75 ÷ 3 = 54.25.
- s = √54.25 ≈ 7.37.

Answer: _____

Z-score

28. Find the z-score and interpret it:

- z = (x − μ) / σ.
- z = ({x_val} − {mu}) / {sigma} = {diff} / {sigma} = {answer}.
- z = 1.36: score is 1.36 standard deviation(s) above the mean.

Answer: _____

29. Find the z-score and interpret it:

- z = (x − μ) / σ.
- z = ({x_val} − {mu}) / {sigma} = {diff} / {sigma} = {answer}.
- z = 3.0: score is 3.0 standard deviation(s) above the mean.

Answer: _____

30. Find the z-score and interpret it:

- z = (x − μ) / σ.
- z = ({x_val} − {mu}) / {sigma} = {diff} / {sigma} = {answer}.
- z = 1.73: score is 1.73 standard deviation(s) above the mean.

Answer: _____