Name: _____ Date: _____

Service time measurements

Service times (minutes): 6, 7, 8, 8, 9, 10, 10, 10, 11, 12, 12, 13, 14, 15, 40. Use the median excluded quartile convention and the ordinary 1.5 IQR outlier rule.

(a) Find the five number summary. Leave the median out of both halves when finding quartiles.

Set it up: Five number summary = minimum, Q1, median, Q3, maximum. Use the median excluded convention throughout.

Work: Ordered data: 6, 7, 8, 8, 9, 10, 10, 10, 11, 12, 12, 13, 14, 15, 40. n = 15; median = 10. Lower half: 6, 7, 8, 8, 9, 10, 10. Upper half: 11, 12, 12, 13, 14, 15, 40. Their medians are Q1 = 8 and Q3 = 13.

Answer: 6, 8, 10, 13, 40.

(b) Find the IQR and the two 1.5 IQR fences. Identify any outliers.

Set it up: IQR = Q3 minus Q1. Lower fence = Q1 minus 1.5 x IQR. Upper fence = Q3 plus 1.5 x IQR.

Work: IQR = 13 minus 8 = 5. Lower = 8 minus 1.5 x 5 = 0.5. Upper = 13 plus 1.5 x 5 = 20.5.

Answer: Fences: 0.5 and 20.5. Outliers: 40. Only values strictly outside the fences are outliers.

(c) Draw a modified boxplot. Label the median and the whisker endpoints. Show outliers separately.

Set it up: Draw the box from Q1 to Q3, a line at the median, and whiskers to the smallest and largest values inside the fences.

Work: Box: 8 to 13. Median: 10. Whiskers: 6, 15. Separate outliers: 40.

Answer: The plotted whiskers end at 6 and 15.



(d) Describe the tail pattern and choose a suitable measure of center. What information does the boxplot hide?

Set it up: A long tail suggests skew. The median is resistant to outliers. A boxplot summarizes quartiles, not every observation.

Work: The high value 40 extends the right tail.

Answer: The data show a longer right tail. The median is a suitable resistant center. A boxplot alone does not show sample size, all exact values, or clusters.

Daily change measurements

Daily changes (units): -18, 2, 3, 4, 4, 5, 5, 6, 6, 7, 8, 8, 9, 10, 11. Use the median excluded quartile convention and the ordinary 1.5 IQR outlier rule.

(a) Find the five number summary. Leave the median out of both halves when finding quartiles.

Set it up: Five number summary = minimum, Q1, median, Q3, maximum. Use the median excluded convention throughout.

Work: Ordered data: -18, 2, 3, 4, 4, 5, 5, 6, 6, 7, 8, 8, 9, 10, 11. n = 15; median = 6. Lower half: -18, 2, 3, 4, 4, 5, 5. Upper half: 6, 7, 8, 8, 9, 10, 11. Their medians are Q1 = 4 and Q3 = 8.

Answer: -18, 4, 6, 8, 11.

(b) Find the IQR and the two 1.5 IQR fences. Identify any outliers.

Set it up: IQR = Q3 minus Q1. Lower fence = Q1 minus 1.5 x IQR. Upper fence = Q3 plus 1.5 x IQR.

Work: IQR = 8 minus 4 = 4. Lower = 4 minus 1.5 x 4 = -2. Upper = 8 plus 1.5 x 4 = 14.

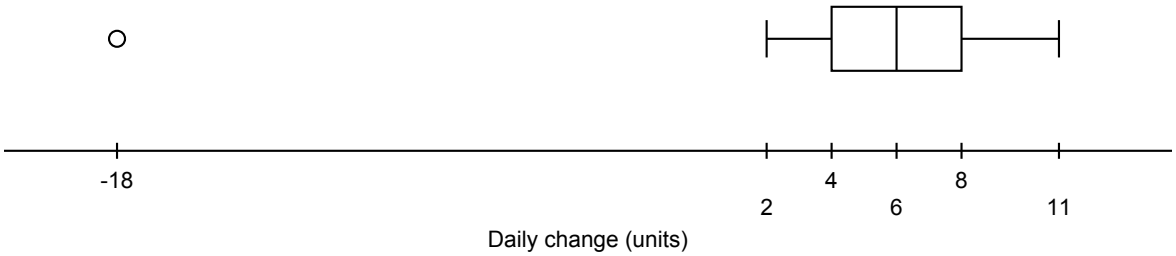
Answer: Fences: -2 and 14. Outliers: -18. Only values strictly outside the fences are outliers.

(c) Draw a modified boxplot. Label the median and the whisker endpoints. Show outliers separately.

Set it up: Draw the box from Q1 to Q3, a line at the median, and whiskers to the smallest and largest values inside the fences.

Work: Box: 4 to 8. Median: 6. Whiskers: 2, 11. Separate outliers: -18.

Answer: The plotted whiskers end at 2 and 11.



(d) Describe the tail pattern and choose a suitable measure of center. What information does the boxplot hide?

Set it up: A long tail suggests skew. The median is resistant to outliers. A boxplot summarizes quartiles, not every observation.

Work: The low value negative 18 extends the left tail.

Answer: The data show a longer left tail. The median is a suitable resistant center. A boxplot alone does not show sample size, all exact values, or clusters.

Quartile practice

Service times (minutes): 2, 4, 5, 7, 8, 9, 12, 14, 15, 18, 29. Use the median excluded quartile convention and the ordinary 1.5 IQR outlier rule.

(a) Find the five number summary. Leave the median out of both halves when finding quartiles.

Set it up: Five number summary = minimum, Q1, median, Q3, maximum. Use the median excluded convention throughout.

Work: Ordered data: 2, 4, 5, 7, 8, 9, 12, 14, 15, 18, 29. n = 11; median = 9. Lower half: 2, 4, 5, 7, 8. Upper half: 12, 14, 15, 18, 29. Their medians are Q1 = 5 and Q3 = 15.

Answer: 2, 5, 9, 15, 29.

(b) Find the IQR and the two 1.5 IQR fences. Identify any outliers.

Set it up: IQR = Q3 minus Q1. Lower fence = Q1 minus 1.5 x IQR. Upper fence = Q3 plus 1.5 x IQR.

Work: IQR = 15 minus 5 = 10. Lower = 5 minus 1.5 x 10 = -10. Upper = 15 plus 1.5 x 10 = 30.

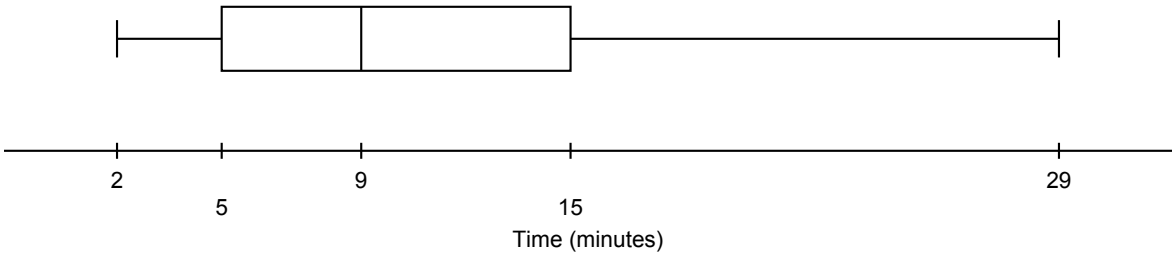
Answer: Fences: -10 and 30. Outliers: none. Only values strictly outside the fences are outliers.

(c) Draw a modified boxplot. Label the median and the whisker endpoints. Show outliers separately.

Set it up: Draw the box from Q1 to Q3, a line at the median, and whiskers to the smallest and largest values inside the fences.

Work: Box: 5 to 15. Median: 9. Whiskers: 2, 29. Separate outliers: none.

Answer: The plotted whiskers end at 2 and 29.



(d) Describe the tail pattern and choose a suitable measure of center. What information does the boxplot hide?

Set it up: A long tail suggests skew. The median is resistant to outliers. A boxplot summarizes quartiles, not every observation.

Work: The upper half and right whisker are longer than their lower counterparts; 29 is still inside the upper fence.

Answer: The data show a longer right tail. The median is a suitable resistant center. A boxplot alone does not show sample size, all exact values, or clusters.