Box Plots and IQR

Name: _____ Date: _____ Score: _____ / 24

Quick Review

A **box plot** displays a data set's **five-number summary**: the *minimum*, the **first quartile** Q_1, the **median**, the **third quartile** Q_3, and the *maximum*. To find them, sort the data, find the median (the middle), then Q_1 is the median of the *lower half* and Q_3 is the median of the *upper half*. (When the count is odd, leave the overall median out of both halves.) The **interquartile range** is IQR $= Q_3 - Q_1$ — it measures the spread of the *middle half* of the data and is not affected by extreme values.

◇ **Example:** Find the five-number summary and IQR of $5,\ 7,\ 9,\ 11,\ 13,\ 15,\ 17$.

⇒ The data is already sorted, and there are 7 values, so the **median** is the 4th value: 11. The *lower half* is $5, 7, 9$ (everything before the median), so Q_1 is its middle value, 7. The *upper half* is $13, 15, 17$, so Q_3 is its middle value, 15. The minimum is 5 and the maximum is 17. Finally, IQR $= Q_3 - Q_1 = 15 - 7 = 8$.

Answer: $\min 5,\ Q_1 7,\ \text{med}\ 11,\ Q_3 15,\ \max 17;\ \text{IQR} = 8$

PRACTICE

Find the five-number summary and IQR of each data set.

1. $2,\ 4,\ 6,\ 8,\ 10$ _____

2. $1,\ 3,\ 5,\ 7,\ 9,\ 11,\ 13$ _____

3. $10,\ 12,\ 14,\ 16,\ 18,\ 20$ _____

4. $5,\ 7,\ 9,\ 11,\ 13,\ 15,\ 17,\ 19$ _____

5. $3,\ 3,\ 5,\ 7,\ 9$ _____

6. $2,\ 2,\ 4,\ 6,\ 8,\ 10,\ 12$ _____

7. $4,\ 8,\ 12,\ 16,\ 20,\ 24$ _____

8. $11,\ 13,\ 15,\ 17,\ 19$ _____

9. $6,\ 6,\ 6,\ 10,\ 14,\ 18$ _____

10. $1,\ 4,\ 7,\ 10,\ 13,\ 16,\ 19$ _____

11. $2,\ 5,\ 8,\ 11,\ 14,\ 17,\ 20,\ 23$ _____

12. $9,\ 9,\ 9,\ 9,\ 15$ _____

13. $10,\ 20,\ 30,\ 40,\ 50,\ 60$ _____

14. $5,\ 5,\ 10,\ 10,\ 15,\ 15$ _____

15. $2,\ 4,\ 4,\ 6,\ 8,\ 10,\ 12$ _____

16. $7,\ 8,\ 9,\ 10,\ 11,\ 12,\ 13$ _____

17. For $5,\ 8,\ 12,\ 16,\ 19,$ find the range _____

18. If $Q_1 = 14$ and $Q_3 = 22,$ find the IQR _____

19. If $Q_1 = 30$ and IQR $= 25,$ find Q_3 _____

20. For $6,\ 6,\ 6,\ 6,$ find the IQR _____

Word Problems

21. A class scored $60,\ 70,\ 80,\ 90,\ 100$ on a quiz. Find the five-number summary and the IQR. _____

22. Daily high temperatures were $58,\ 62,\ 66,\ 70,\ 74,\ 78,\ 82$ degrees. Find the IQR and explain what it tells you. _____

23. Two stores' wait times (minutes) are Store A: $2,\ 4,\ 6,\ 8,\ 10$ and Store B: $4,\ 5,\ 6,\ 7,\ 8$. Which store's middle half is more spread out? _____

24. A coach records long-jump distances (ft): $9,\ 11,\ 13,\ 15,\ 17,\ 19$. Find Q_1, Q_3, and the IQR. _____

Answer Keys

1. $2,\ 3,\ 6,\ 9,\ 10$; IQR 6
2. $1,\ 3,\ 7,\ 11,\ 13$; IQR 8
3. $10,\ 12,\ 15,\ 18,\ 20$; IQR 6
4. $5,\ 8,\ 12,\ 16,\ 19$; IQR 8
5. $3,\ 3,\ 5,\ 8,\ 9$; IQR 5
6. $2,\ 2,\ 6,\ 10,\ 12$; IQR 8
7. $4,\ 8,\ 14,\ 20,\ 24$; IQR 12
8. $11,\ 12,\ 15,\ 18,\ 19$; IQR 6
9. $6,\ 6,\ 8,\ 14,\ 18$; IQR 8
10. $1,\ 4,\ 10,\ 16,\ 19$; IQR 12
11. $2,\ 6.5,\ 12.5,\ 18.5,\ 23$; IQR 12
12. $9,\ 9,\ 9,\ 12,\ 15$; IQR 3
13. $10,\ 20,\ 35,\ 50,\ 60$; IQR 30
14. $5,\ 5,\ 10,\ 15,\ 15$; IQR 10
15. $2,\ 4,\ 6,\ 10,\ 12$; IQR 6
16. $7,\ 8,\ 10,\ 12,\ 13$; IQR 4
17. 14
18. 8
19. 55
20. 0
21. $\min 60,\ Q_1 65,\ \text{med}\ 80,\ Q_3 95,\ \max 100$; IQR $= 30$
22. IQR $= 16$ degrees
23. Store A IQR $= 6$, Store B IQR $= 3$; Store A is more spread out
24. $Q_1 = 11,\ Q_3 = 17$; IQR $= 6$

Step-by-Step Explanations

1. Median $= 6$. Lower half $2, 4$ gives $Q_1 = 3$; upper half $8, 10$ gives $Q_3 = 9$. IQR $= 9 - 3 = 6$.

2. Median $= 7$. Lower half $1, 3, 5$ gives $Q_1 = 3$; upper half $9, 11, 13$ gives $Q_3 = 11$. IQR $= 8$.

3. Median $= \frac{14+16}{2} = 15$. Lower half $10, 12, 14$ gives $Q_1 = 12$; upper half $16, 18, 20$ gives $Q_3 = 18$. IQR $= 6$.

4. Median $= \frac{11+13}{2} = 12$. Lower half $5, 7, 9, 11$ gives $Q_1 = 8$; upper half $13, 15, 17, 19$ gives $Q_3 = 16$. IQR $= 8$.

5. Median $= 5$. Lower half $3, 3$ gives $Q_1 = 3$; upper half $7, 9$ gives $Q_3 = 8$. IQR $= 8 - 3 = 5$.

6. Median $= 6$. Lower half $2, 2, 4$ gives $Q_1 = 2$; upper half $8, 10, 12$ gives $Q_3 = 10$. IQR $= 8$.

7. Median $= \frac{12+16}{2} = 14$. Lower half $4, 8, 12$ gives $Q_1 = 8$; upper half $16, 20, 24$ gives $Q_3 = 20$. IQR $= 12$.

8. Median $= 15$. Lower half $11, 13$ gives $Q_1 = 12$; upper half $17, 19$ gives $Q_3 = 18$. IQR $= 6$.

9. Median $= \frac{6+10}{2} = 8$. Lower half $6, 6, 6$ gives $Q_1 = 6$; upper half $10, 14, 18$ gives $Q_3 = 14$. IQR $= 8$.

10. Median $= 10$. Lower half $1, 4, 7$ gives $Q_1 = 4$; upper half $13, 16, 19$ gives $Q_3 = 16$. IQR $= 12$.

11. Median $= \frac{11+14}{2} = 12.5$. Lower half $2, 5, 8, 11$ gives $Q_1 = 6.5$; upper half $14, 17, 20, 23$ gives $Q_3 = 18.5$. IQR $= 12$.

12. Median $= 9$. Lower half $9, 9$ gives $Q_1 = 9$; upper half $9, 15$ gives $Q_3 = 12$. IQR $= 12 - 9 = 3$.

13. Median $= \frac{30+40}{2} = 35$. Lower half $10, 20, 30$ gives $Q_1 = 20$; upper half $40, 50, 60$ gives $Q_3 = 50$. IQR $= 30$.

14. Median $= \frac{10+10}{2} = 10$. Lower half $5, 5, 10$ gives $Q_1 = 5$; upper half $10, 15, 15$ gives $Q_3 = 15$. IQR $= 10$.

15. Median $= 6$. Lower half $2, 4, 4$ gives $Q_1 = 4$; upper half $8, 10, 12$ gives $Q_3 = 10$. IQR $= 6$.

16. Median $= 10$. Lower half $7, 8, 9$ gives $Q_1 = 8$; upper half $11, 12, 13$ gives $Q_3 = 12$. IQR $= 4$.

17. Range $=$ max $-$ min $= 19 - 5 = 14$.

18. IQR $= Q_3 - Q_1 = 22 - 14 = 8$.

19. Since IQR $= Q_3 - Q_1$, we get $Q_3 = Q_1 + \text{IQR} = 30 + 25 = 55$.

20. All values are equal, so $Q_1 = Q_3 = 6$ and IQR $= 0$ — no spread at all.

21. Median $= 80$. Lower half $60, 70$ gives $Q_1 = 65$; upper half $90, 100$ gives $Q_3 = 95$. So IQR $= 95 - 65 = 30$.

22. Median $= 70$. Lower half $58, 62, 66$ gives $Q_1 = 62$; upper half $74, 78, 82$ gives $Q_3 = 78$. IQR $= 78 - 62 = 16$ — the middle half of days spans 16 degrees.

23. Store A: median 6, $Q_1 = 3$, $Q_3 = 9$, so IQR $= 6$. Store B: median 6, $Q_1 = 4.5$, $Q_3 = 7.5$, so IQR $= 3$. Store A's middle half is more spread out.

24. Median $= \frac{13+15}{2} = 14$. Lower half $9, 11, 13$ gives $Q_1 = 11$; upper half $15, 17, 19$ gives $Q_3 = 17$. IQR $= 17 - 11 = 6$.

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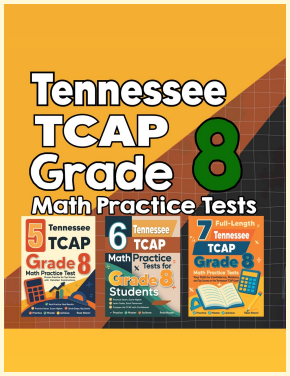

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