Measures of Spread

Measures of spread: Mistakes and missing information

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QUICK REVIEW

Range = maximum − minimum. IQR = $Q_3 - Q_1$ describes the middle half. Split sorted data into two halves; for an odd count omit the overall median from both halves. MAD averages absolute distances from the mean. For $2, 4, 6, 8$, range $= 6$, $Q_1 = 3, Q_3 = 7$, IQR $= 4$, mean $= 5$, MAD $= (3 + 1 + 1 + 3)/4 = 2$.

Worked example

Find mean absolute deviation. Data: $2, 4, 6, 8$.

1. Mean $= 20/4 = 5$.
2. Absolute distances from 5: $3, 1, 1, 3$; their sum is 8.
3. MAD $= 8/4 = 2$ units.
Answer: MAD $= 2$ units.

Practice Problems

Show your thinking.

1. A student subtracts largest from smallest. Correct the negative range. Data: $1, 2, 4, 7$.

2. A student includes the overall median in both halves. Use the stated convention to correct IQR. Data: $1, 3, 5, 7, 9, 11, 13$.

3. A student adds signed deviations and gets zero MAD. Correct it. Data: $0, 2, 4, 6$.

4. Recover Q_1, Q_3, then their difference. Data: $4, 6, 8, 10$.

5. A student divides distance sum by 3 instead of 4. Correct MAD. Data: $3, 3, 7, 7$.

6. Explain which observations control the range. Data: $2, 5, 8, 11, 14$.

Answer Key

1. Range $= 6$ units.
2. IQR $= 8$ units.
3. MAD $= 2$ units.
4. $Q_1 = 5, Q_3 = 9$; IQR 4 units.
5. MAD $= 2$ units.
6. Range $= 12$ units.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Minimum 1 and maximum 7 are the endpoints.
2. Range $= 7 - 1 = 6$ units.

Problem 2

1. Lower half $1, 3, 5$ has median $Q_1 = 3$; upper half $9, 11, 13$ has median $Q_3 = 11$.
2. IQR $= Q_3 - Q_1 = 11 - 3 = 8$ units.

Problem 3

1. Mean $= 12/4 = 3$.
2. Absolute distances from 3: $3, 1, 1, 3$; their sum is 8.
3. MAD $= 8/4 = 2$ units.

Problem 4

1. Lower half $4, 6$ has median $Q_1 = 5$; upper half $8, 10$ has median $Q_3 = 9$.
2. IQR $= Q_3 - Q_1 = 9 - 5 = 4$ units.

Problem 5

1. Mean $= 20/4 = 5$.
2. Absolute distances from 5: $2, 2, 2, 2$; their sum is 8.
3. MAD $= 8/4 = 2$ units.

Problem 6

1. Minimum 2 and maximum 14 are the endpoints.
2. Range $= 14 - 2 = 12$ units.

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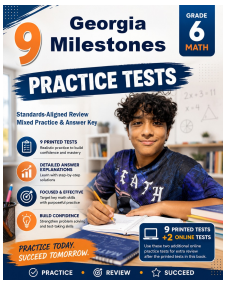

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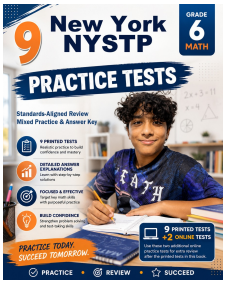

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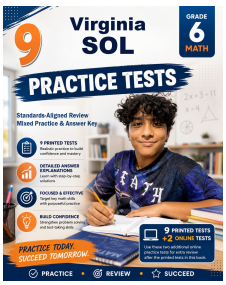

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