

Solutions

2.1

Subtract the minimum from the maximum.

$$R = x_{max} - x_{min} = 12 - 3 = 9$$

Range 9.

2.2

$$IQR = Q_3 - Q_1 = 13 - 7 = 6. \text{ Range } R = 20 - 4 = 16.$$

2.3

Median is the mean of the fourth and fifth values: $m = (8 + 10)/2 = 9$. Lower-half median $Q_1 = (4 + 6)/2 = 5$. Upper-half median $Q_3 = (12 + 14)/2 = 13$.

2.4

Mean $\mu = (2 + 4 + 6)/3 = 4$.

$$\sigma^2 = \frac{\sum(x - \mu)^2}{n} = \frac{(2 - 4)^2 + (4 - 4)^2 + (6 - 4)^2}{3} = \frac{8}{3}$$

Population variance.

$$\sigma = \sqrt{\sigma^2} = \sqrt{8/3} \approx 1.63$$

Population standard deviation.

3.1

Both means are 5. Use population division by n, not n minus 1.

$$\sigma_A = \sqrt{\frac{(4 - 5)^2 + (5 - 5)^2 + (6 - 5)^2}{3}} = \sqrt{2/3} \approx 0.816$$

A standard deviation.

$$\sigma_B = \sqrt{\frac{(1 - 5)^2 + (5 - 5)^2 + (9 - 5)^2}{3}} = \sqrt{32/3} \approx 3.27$$

B standard deviation. B is more spread around the shared mean. The summaries do not identify why the populations differ.

3.2

(a) Five-number summary is 2, 5, 9, 13, 16. Correct quartiles and median earn B1; a box from 5 to 13 with median 9 earns B1; whiskers to 2 and 16 on a labelled scale earn B1.

(b) Range $R = 16 - 2 = 14$. IQR = $13 - 5 = 8$.

(c) New range $R' = 100 - 2 = 98$. Quartiles stay 5 and 13, so IQR remains 8. The range uses the changed extreme directly, while the middle-half endpoints stay fixed; neither the plot nor these summaries establishes the cause of 100. Do not delete that value without checking its origin.