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Notes:

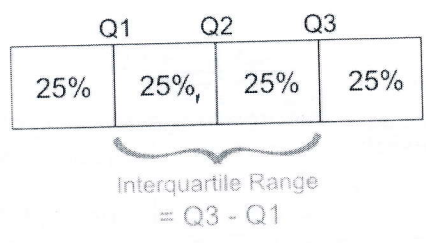
Measures of Spread

Created for you by Ms. Ninotsavbanh

Measures of spread describe how data values are spread out or scattered from the center. The range and the interquartile range are used to measure the spread of the data.

Range – is the difference between the greatest and the least data values.

Interquartile range (IQR) – is the difference between the third and first quartiles. It represents the range of the middle half of the data.

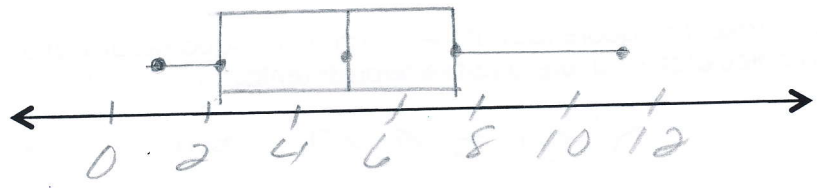


Example 1: Find the median, range, and interquartile range.

1, 1, 3, 5, 5, 6, 8, 11

- a) median = 5
- b) range = 10 $11 - 1 = 10$
- c) interquartile range = 5 $7 - 2 = 5$
- d.) Construct a box plot for the data.

min = 1
max = 11
median = 5
 $Q1 = 2$
 $Q3 = 7$



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Standard Deviation, another measure of spread, represents the average of the distances between individual data values and the mean.

The formula for finding the standard deviation of the data set is:

$$\text{Standard deviation} = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n}}$$

where \bar{x} is

the mean of the set of data, and n is the number of data values.

Example 2: Calculate the standard deviation for the data below.

$$\sum x = 430 \quad 77, 84, 86, 90, 93 \quad \bar{x} = 86$$

Step 1: Find the mean. $\frac{430}{5} = 86$

Step 2: Complete the table.

| Data value, x | Deviation from mean, $x - \bar{x}$ | Squared deviation, $(x - \bar{x})^2$ |
|-----------------|------------------------------------|--------------------------------------|
| 77 | $77 - 86 = -9$ | $(-9)^2 = 81$ |
| 84 | $84 - 86 = -2$ | $(-2)^2 = 4$ |
| 86 | $86 - 86 = 0$ | $(0)^2 = 0$ |
| 90 | $90 - 86 = 4$ | $(4)^2 = 16$ |
| 93 | $93 - 86 = 7$ | $(7)^2 = 49$ |

Step 3: Find the mean of the squared deviations.

$$\frac{81 + 4 + 0 + 16 + 49}{5} = 30$$

Step 4: Take the square root of the mean of the squared deviations. Use a calculator, and round to the nearest tenth.

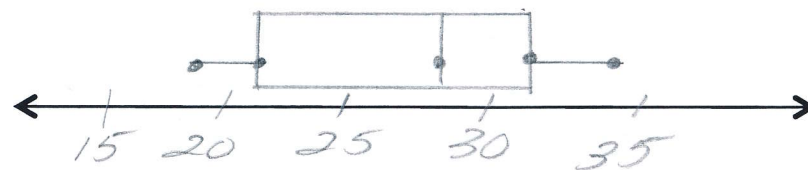
$$\sqrt{30} \approx 5.5$$

The standard deviation is approximately 5.5

Example 3: Construct a box plot for the data below. Then find the range, IQR, and standard deviation.

19, 25, 31, 19, 34, 22, 31, 34

$$\begin{aligned} \text{min} &= 19 & Q3 &= 32.5 \\ Q1 &= 20.5 & \text{max} &= 34 \\ \text{median} &= 28 \end{aligned}$$



Range = $\frac{15}{34 - 19 = 15}$ IQR = $\frac{12}{32.5 - 20.5 = 12}$
 The standard deviation is approximately 6.0

Review cumulative frequency histogram:

The cumulative frequency table below shows the length of time that 30 students spent text messaging on a weekend.

| Minutes Used | Cumulative Frequency |
|--------------|----------------------|
| 31-40 | 2 |
| 41-50 | 5 |
| 51-60 | 10 |
| 61-70 | 19 |
| 71-80 | 30 |

4. Which 10-minute interval contains the first quartile?

- (1) 31-40 (2) 41-50 (3) 51-60 (4) 61-70

$$\frac{1}{4} \left(\frac{30}{1} \right) = 7.5$$

5. Which 10-minute interval contains the median?

- (1) 31-40 (2) 41-50 (3) 51-60 (4) 61-70

$$\frac{1}{2} (30) = 15$$