

Worksheet 8-6: Measures of Spread

Measures of central tendency are values around which a set of data tends to cluster. However, to analyze a set of data, it is useful to know how spread out the data are. Measures of spread describe how the values in a set of data are distributed. Several quantities can be used to measure the spread in a set of data.

Common Measures of Spread:

- **Range**

The range is the difference between the greatest and least values in a set of data. To calculate the range, subtract the least value from the greatest value.

$$\text{Range} = \text{Greatest value} - \text{Least value}$$

- **Variance**

The variance is a measure of how spread out the values in a set of data are from the mean. It is the average of the squares of the deviations from the mean for a set of data.

Note: The greater the variance, the greater the spread of the data values

$$\text{Variance} = \frac{(x_1 - \text{mean})^2 + (x_2 - \text{mean})^2 + (x_3 - \text{mean})^2 + \dots + (x_n - \text{mean})^2}{n}$$

where $x_1, x_2, x_3, \dots, x_n$ are values in the set of data (x_1 is the first value, x_2 is the second value and so on, until x_n which is the n^{th} value or the last value), and n is the number of values in the set of data

- **Standard Deviation**

The standard deviation is another measure of how spread out the values in a set of data are from the mean. It is the typical distance of a particular value from the mean.

Note: The greater the standard deviation, the greater the spread of the data values

$$\text{Standard Deviation} = \sqrt{\text{Variance}}$$

- **Quartiles**

Quartiles are three values that divide a set of data into four intervals with equal numbers of data. First Quartile is the median of the first half of the data, Second Quartile is the median of the entire set of data, Third Quartile is the median of the second half of the data.

- **Interquartile Range**

Interquartile range measures how closely data clusters around the median. It is the range of the central half of a set of data when the data are arranged from least to greatest. The interquartile range is the difference between the upper quartile and the lower quartile.

$$\text{Interquartile Range} = \text{Third Quartile} - \text{First Quartile}$$

1. Iris works part-time selling cell phones. She recorded the numbers of cell phones she sold each month for the last 12 months: 51, 17, 25, 39, 7, 49, 62, 41, 20, 6, 43, 13.

(a) Find the median.

(b) Find the first quartile (Q1).

(c) Find the third quartile (Q3).

(d) Find the interquartile range.

2. Carmella's monthly gasoline expenses, in dollars, for the past year are shown.

61, 83, 77, 88, 67, 71, 65, 72, 67, 84, 90, 80

(a) Calculate the range, to the nearest dollar.

(b) Calculate the variance, to the nearest dollar.

(c) Calculate the standard deviation, to the nearest dollar.

- 3.** This set of data shows the numbers of customers who made purchases at a coffee shop each day in one month.

114, 142, 59, 122, 111, 128, 158, 79, 88, 107, 133,
131, 113, 152, 149, 99, 84, 112, 104, 109, 122,
131, 144, 155, 139, 142, 119, 80, 127, 140, 135

- (a) Find the median for the set of data.

- (b) Find the first quartile.

- (c) Find the third quartile.

- (d) What is the interquartile range?

- 4.** A set of data has a range of 30. The least value in the set of data is 22. What is the greatest value in the set of data?

5. Find the range of each set of data.

(a) the number of hours worked by the restaurant staff in a given week:

11, 4, 55, 42, 41, 36, 50, 6, 8, 44, 39

(b) the number of songs Jermaine downloaded each month:

12, 11, 9, 12, 13, 15, 14, 11, 11, 8, 6, 7

6. A set of data has a range of 14. The greatest value in the set is 116. What is the least value in the set of data?

7. Each measurement is the variance for a set of data. Find the standard deviation for each set of data. Round your answers to one decimal place, if necessary.

(a) 154 g

(b) 36 m

8. Each measurement is the standard deviation for a set of data. Find the variance for each set of data.

(a) 14.1 cm

(b) 3.5 kg

9. Andrew is still working with the attendance figures, in thousands of people, for the fall fair over the past 20 years. The data, in thousands, are:

23, 31, 44, 27, 32, 41, 35, 42, 37, 41, 43, 39, 36, 37, 43, 27, 36, 42, 41, 43

(a) Find the range.

(b) Find the variance.

(c) Find the standard deviation.

Answers: 1. (a) 32 phones, (b) 15 phones, (c) 46 phones, (d) 31 phones; 2. (a) \$29, (b) \$85 (Mean = \$75), (c) \$9;
3. (a) 122, (b) 107, (c) 140, (d) 33; 4. 52; 5. (a) 51 hours, (b) 9 songs; 6. 102; 7. (a) 12.4 g, (b) 6 m;
8. (a) 198.81 cm, (b) 12.25 kg; 9. (a) 21 000, (b) 36 100 000, (c) 6008.