

Chapter 4: Measures of Location (part 2)





Learning Outcomes

After Completing the chapter ,you will able to :

- Compute the different types of measures of location.
- Understand the applications of different types of measures of location.
- Box plot and construction process of box plot.



Contents

From this lecture, you are going to learn...

- Construction of Box-Whisker-Plot
- Uses of it



Box-Whisker plot

The Summary statistics, required to draw Box-Whisker-plot are:

1. 1st quartile = Q_1
2. 2nd quartile = Q_2 = Median
3. 3rd quartile = Q_3
4. Smallest value = S
5. Highest value = H
6. Inter Quartile Range, $IQR = Q_3 - Q_1$



Box-Whisker plot

The fences to detect outliers in the Box-Whisker-Plot are:

Inner Fences:



$$Q_1 - 1.5 \times \text{IQR}$$

&

$$Q_3 + 1.5 \times \text{IQR}$$

Outer Fences:



$$Q_1 - 3 \times \text{IQR}$$

&

$$Q_3 + 3 \times \text{IQR}$$



Box-Whisker plot

Example: The monthly starting salaries in dollar for a random sample 12-business school graduates are as follows:

2900, 2765, 2960, 2890, 2880, 2720, 2930, 2950, 2860, 3060, 3260, 3525

Solution:

Arranging the data to the smallest to largest,

2720, 2765, 2860, 2880, 2890, 2900, 2930, 2950, 2960, 3060, 3260, 3525

1. Position of 1st quartile $Q_1 = \frac{1 \times 12}{4} = 3$

$$\therefore 1^{\text{st}} \text{ quartile } Q_1 = \frac{3^{\text{rd}} + 4^{\text{th}}}{2} = \frac{2860 + 2880}{2} = 2870$$



Box-Whisker plot

2729, 2765, 2860, 2880, 2890, 2900, 2930, 2950, 2960, 3060, 3260, 3525

2. Position of 2nd quartile $Q_2 = \frac{2 \times 12}{4} = 6$

$$\therefore 2^{\text{nd}} \text{ quartile } Q_2 = \frac{6^{\text{th}} + 7^{\text{th}}}{2} = \frac{2900 + 2930}{2} = 2915$$

3. Position of 3rd quartile $Q_3 = \frac{3 \times 12}{4} = 9$

$$\therefore 3^{\text{rd}} \text{ quartile } Q_3 = \frac{9^{\text{th}} + 10^{\text{th}}}{2} = \frac{2960 + 3060}{2} = 3010$$



Box-Whisker plot

2720, 2765, 2860, 2880, 2890, 2900, 2930, 2950, 2960, 3060, 3260, 3525

4. Smallest value = 2720

5. Highest value = 3525

6. Inter Quartile Range, $IQR = Q_3 - Q_1 = 3010 - 2870 = 140$



Box-Whisker plot

2729, 2765, 2860, 2880, 2890, 2900, 2930, 2950, 2960, 3060, 3260, 3425

Inner Fences:

$$Q_1 - 1.5 \times \text{IQR} = 2870 - 1.5 * 140 = 2660$$

&

$$Q_3 + 1.5 \times \text{IQR} = 3010 + 1.5 * 140 = 3220$$

Outer Fences:

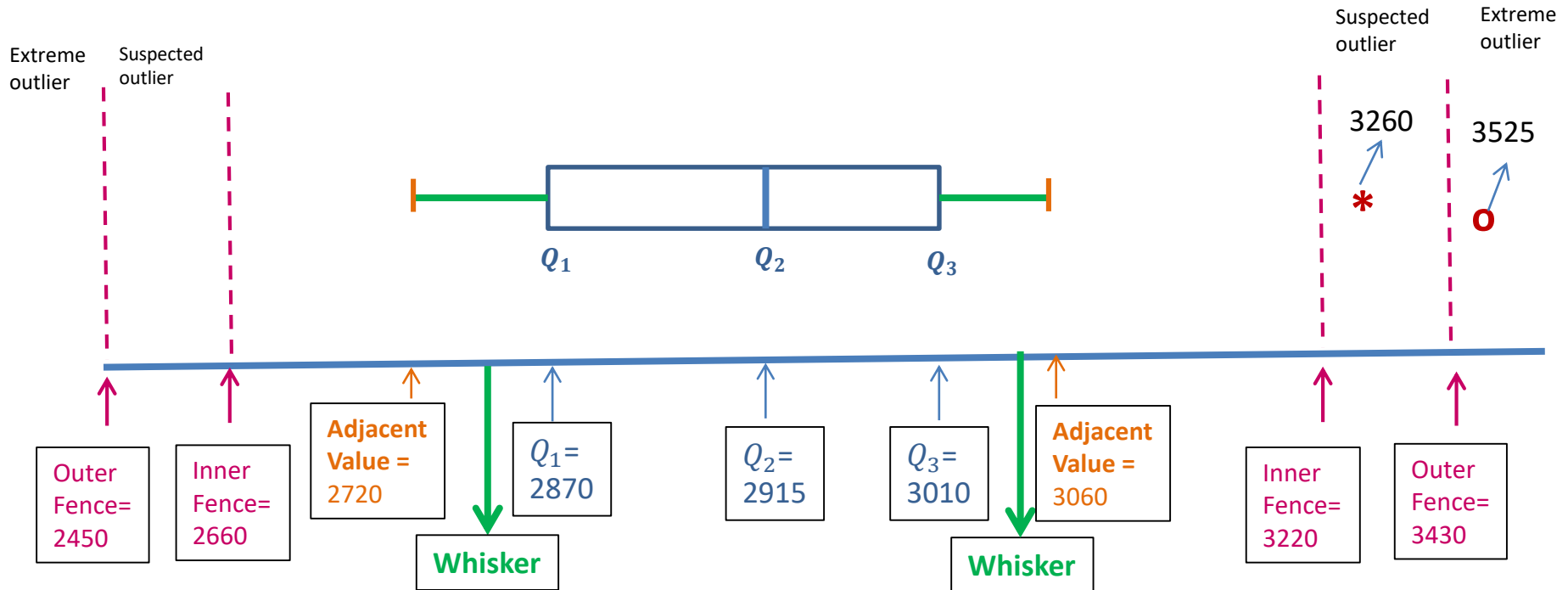
$$Q_1 - 3 \times \text{IQR} = 2870 - 3 * 140 = 2450$$

&

$$Q_3 + 3 \times \text{IQR} = 3010 + 3 * 140 = 3430$$

Box-Whisker plot

2720, 2765, 2860, 2880, 2890, 2900, 2930, 2950, 2960, 3060, 3260, 3525





Box-Whisker plot

Uses:

1. To get idea of the shape of the distribution
2. To detect outliers from the data.
3. To get idea about the spread ness of the data set.

From the previous Box-Plot we see that,

1. The shape of the distribution is negatively skewed since left whisker is larger than right whisker.
1. There are 2 outliers in the data. Which are 3260 and 3430.



Exercise

- Construct a Box-and- Whisker Plot for these data and identify if any outliers:
3, 9, 10, 2, 6, 7, 5, 8, 6, 6, 4, 9, 22.

