

Box and Whiskers

A box-and-whiskers plot allows us to get a more accurate description of the data. It allows us to see how the data is dispersed using the following information:

$$\text{Min}, Q_1, Q_2, Q_3, \text{Max}$$

The data is placed in increasing order and then divided by quartiles: Q_1, Q_2, Q_3 . The Q_2 is the median of the data. The quartiles create sections of data each containing up to 25% of the data.

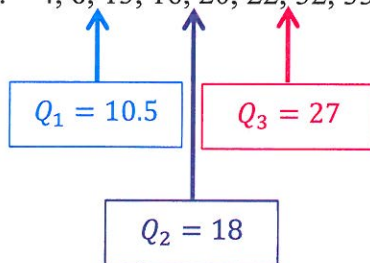
If any of the quartiles are located between two data values, we average the two values to find the quartile in question.

There are 4 cases we need to consider.

CASE 1

The Q_1, Q_2, Q_3 are all located between the data.

Example: 4, 8, 13, 16, 20, 22, 32, 33

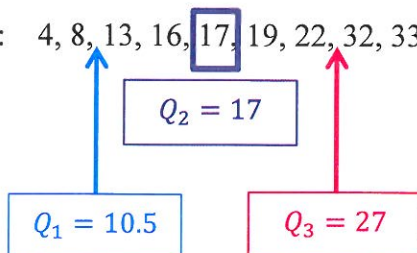


Note:
Case 1 # of data
4, 8, 12, 16, 20, 24, etc.

CASE 2

The median, Q_2 is located in the data and the Q_1 and Q_3 are located between the data.

Example: 4, 8, 13, 16, 17, 19, 22, 32, 33

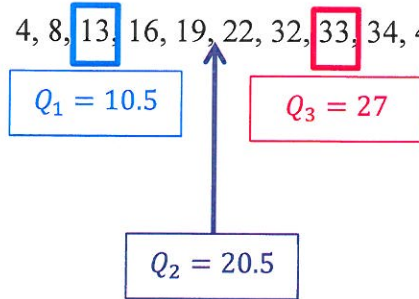


Note:
Case 2 # of data
5, 9, 13, 17, 21, 25, etc.

CASE 3

The median, Q_2 is located between the data and the Q_1 and Q_3 are located in the data.

Example: 4, 8, 13, 16, 19, 22, 32, 33, 34, 41

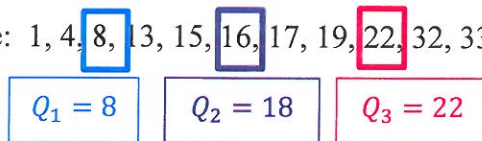


Note:
Case 3 # of data
6, 10, 14, 18, 22, 26, etc.

CASE 4

The Q_1, Q_2, Q_3 are all located in the data.

Example: 1, 4, 8, 13, 15, 16, 17, 19, 22, 32, 33



Note:
Case 4 # of data
7, 11, 15, 19, 23, 27, etc.

How to create a Box-And-Whiskers Plot

Step1: Place data in increasing order (lowest to highest)

1, 4, 8, 9, 10, 13, 16, 17, 20, 21, 22, 28, 32, 33

Step2: Determine the minimum and maximum value

Min: 1

Max: 33

Step3: Determine the median Q_2 by finding the position.

Use the formula: $Position = \frac{n+1}{2}$, where n is the number of data

There are 14 pieces of datum $\therefore n = 14$

<u>Second Quartile (Q_2)</u> Median
$Position = \frac{n + 1}{2}$
$Position = \frac{14 + 1}{2}$
$Position = \frac{15}{2}$
$Position = 7.5^{th}$

Therefore, Q_2 is in the 7.5^{th} position (which means it is between the 7^{th} and 8^{th} position and we must calculate it)

1, 4, 8, 9, 10, 13, 16, 17, 20, 21, 22, 28, 32, 33

The 7^{th} number is 16 and the 8^{th} number is 17

$$Q_2 = \frac{16+17}{2}$$

$$Q_2 = 16.5$$

Step 4: Determine the first and third quartile.

First Quartile (Q_1)

Where n_1 is the number of values located below Q_2

There are 7 datum below the Q_2

$$\text{Position} = \frac{n_1 + 1}{2}$$

$$\text{Position} = \frac{7 + 1}{2}$$

$$\text{Position} = \frac{8}{2}$$

$$\text{Position} = 4^{\text{th}}$$

Q_1 is the 4th number below Q_2

First Quartile (Q_3)

Where n_2 is the number of values located above Q_2

There are 7 datum above the Q_2

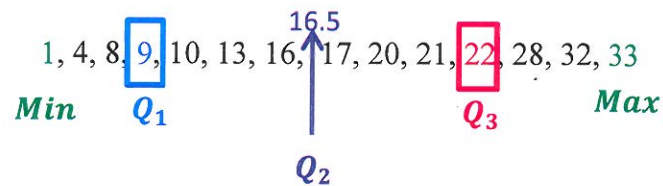
$$\text{Position} = \frac{n_2 + 1}{2}$$

$$\text{Position} = \frac{7 + 1}{2}$$

$$\text{Position} = \frac{8}{2}$$

$$\text{Position} = 4^{\text{th}}$$

Q_3 is the 4th number above Q_2



Step 5: Now that you have the data you draw the box-and-whiskers plot.

Min = 1
 $Q_1 = 9$
 $Q_2 = 16.5$
 $Q_3 = 22$
Max = 33

