

# Dr Oliver Mathematics

## Box Plots: Compare and Contrast

In this note, we look to see how you compare two box plots. We will use 1.5 times the interquartile range to find outliers.

1. The following tables show the marks scored in a test by two groups of eleven students.

Group A : 5, 6, 13, 13, 15, 17, 18, 18, 21, 22, 34

Group B : 6, 10, 11, 14, 14, 15, 19, 20, 23, 23, 26

- (a) Find the quartiles for Group A.

### Solution

Group A : 5, 6, 13, 13, 15, 17, 18, 18, 21, 22, 34

$$\text{LQ} = \underline{13}.$$

$$\text{Median} = \underline{17}.$$

$$\text{UQ} = \underline{21}.$$

- (b) Find the quartiles for Group B.

### Solution

Group B : 6, 10, 11, 14, 14, 15, 19, 20, 23, 23, 26

$$\text{LQ} = \underline{11}.$$

$$\text{Median} = \underline{15}.$$

$$\text{UQ} = \underline{23}.$$

- (c) On the same axes draw box plots for these data.

### Solution

#### Group A

$$\text{IQR} = 21 - 13 = 8 \text{ so } 1.5 \times \text{IQR} = 12.$$

$$\text{Lower: } 13 - 12 = 1 \text{ so no low outliers.}$$

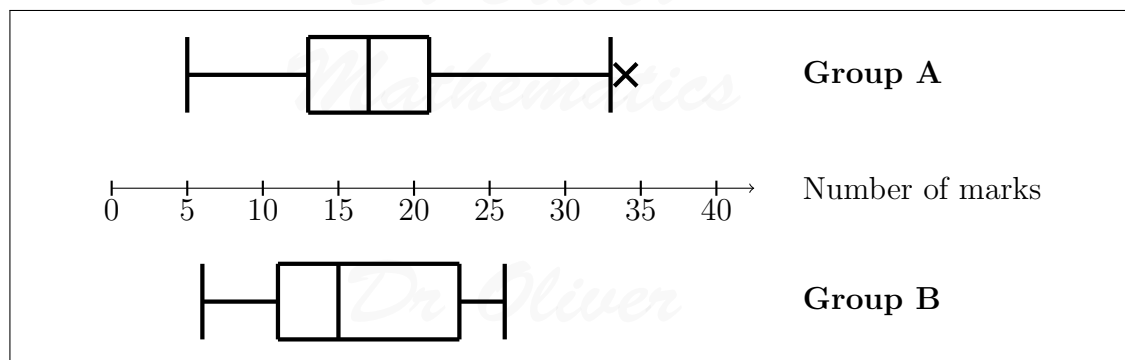
$$\text{Upper: } 21 + 12 = 33 \text{ so } 34 \text{ is an outlier.}$$

#### Group B

$$\text{IQR} = 23 - 11 = 12 \text{ so } 1.5 \times \text{IQR} = 18.$$

$$\text{Lower: } 11 - 18 = -7 \text{ so no low outliers.}$$

$$\text{Upper: } 23 + 18 = 41 \text{ so } 34 \text{ so no high outliers.}$$



(d) Compare and contrast the two data sets.

**Solution**

**Average**

Since the median for Group A is higher than the median for Group B, Group A scored more marks on average.

**Spread**

Since the range for Group B is smaller than the range for Group A, the marks were more consistent in Group B.

**OR**

Since the IQR for Group A is smaller than the IQR for Group B, the marks were more consistent in Group A.

**Outliers**

Group A has a high outlier; Group B has no outliers.

**Skewness**

Group A's marks are symmetrical whereas Group B's marks are positively skewed.

2. The following tables show the times taken (in seconds) by two groups of eleven students.

Group A : 49, 34, 55, 68, 57, 59, 65, 38, 63, 60, 66

Group B : 47, 40, 55, 64, 42, 70, 43, 21, 44, 55, 53

(a) Find the quartiles for Group A.

**Solution**

We need to order the data first:

Group A : 34, 38, 49, 55, 57, 59, 60, 63, 65, 66, 68.

LQ = 49.

Median = 59.

UQ = 65.

(b) Find the quartiles for Group B.

**Solution**

Group B : 21, 40, 42, 43, 44, 47, 53, 55, 55, 64, 70.

LQ = 42.

Median = 47.

UQ = 55.

(c) On the same axes draw box plots for these data.

**Solution**

**Group A**

$IQR = 65 - 49 = 16$  so  $1.5 \times IQR = 24$ .

Lower:  $49 - 24 = 25$  so no low outliers.

Upper:  $65 + 24 = 89$  so no high outliers.

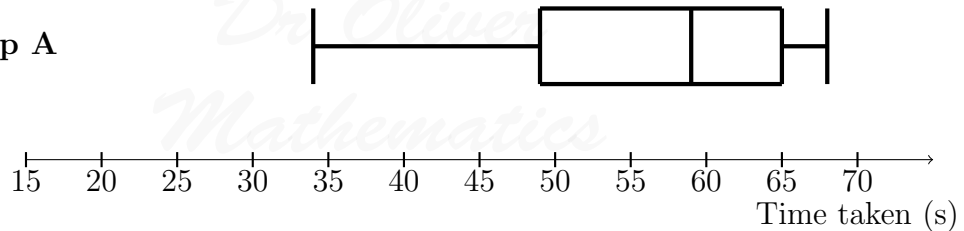
**Group B**

$IQR = 55 - 42 = 13$  so  $1.5 \times IQR = 19.5$ .

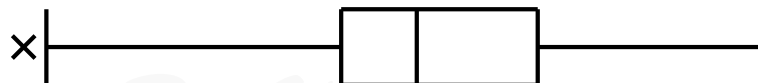
Lower:  $42 - 19.5 = 22.5$  so 21 is a low outlier.

Upper:  $55 + 19.5 = 74.5$  so 34 so no high outliers.

**Group A**



**Group B**



(d) Compare and contrast the two data sets.

**Solution**

**Average**

Since the median for Group B is lower than the median for Group A, Group B were faster on average.

**Spread**

Since the range for Group A is smaller than the range for Group B, the times were more consistent in Group A.

**OR**

Since the IQR for Group B is smaller than the range for Group A, the times were more consistent in Group B.

**Outliers**

Group B has a low outliers; Group A has no outliers.

**Skewness**

Group A's marks are negatively skewed whereas Group B's marks are positively skewed.