

In the previous section, you studied measures of *central* tendency. It is important to note that distributions of continuous data can also be characterized and compared by considering their measures of *spread*.

### PART A-What is the Interquartile Range?

To define these measures of spread, let's consider a familiar context—a class set of MCR 3U midterm marks. The marks are as follows:

90	90
87	74
80	77
75	90
83	67
75	77
78	92
76	80

Using this set of data, determine each of the following:

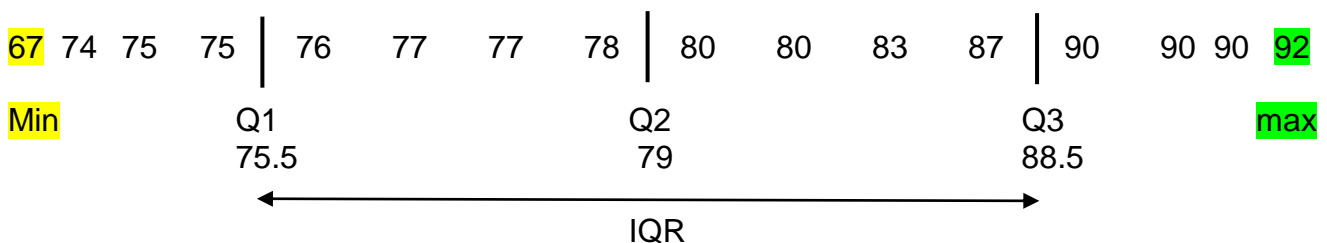
1. the range
2. the quartiles
3. the Interquartile range, and
4. Create a box-and-whisker plot (e.g., on p4 of this document) to represent the spread of data using *Fathom*. Copy the graphic as a picture and then paste into the space provided. Label the graphic with the following: *min*, *max*, *Q1*, *Q2*, *Q3*, *range*, *IQR*.

### **Solution:**

$$\begin{aligned} 1. \text{ Range} &= \text{max} - \text{min} \\ &= 92 - 67 \\ &= 25 \end{aligned}$$

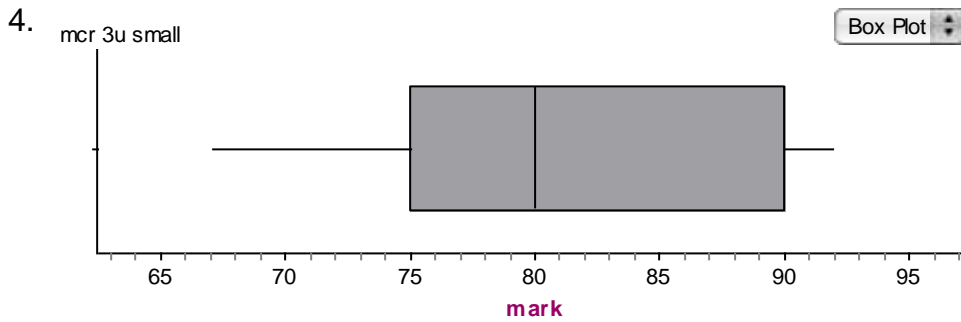
2. The quartiles are the values in a data set that divide the data set into 4, equal parts. Q1 is the first or lower quartile; Q2, the second quartile (or median); and Q3, the third or upper quartile.

It is helpful to arrange the values ( $n = 16$ ) in ascending order.



The IQR is the difference between the upper and lower quartiles. It contains the middle, 50% of the data in a set of data.

$$\begin{aligned} \text{IQR} &= \text{Q3} - \text{Q1} \\ &= 88.5 - 75.5 \\ &= 13 \end{aligned}$$



The plot (above) is called a box and whisker plot. Take note of the placement of the max and min values and the quartiles.

Now consider the set of marks from another semester's MCR 3U class. Repeat steps 1 to 4 from above. **To facilitate the calculation of the quartiles and IQR, input the data into a web-based tool (calculator) for determining these statistics** (e.g., <http://www.mathportal.org/calculators/statistics-calculator/descriptive-statistics-calculator.php>)

**Solution:**

79	75
79	77
76	79
78	82
72	81
85	72
79	79
74	77
74	81
76	77
81	63
63	69
86	67
72	84
78	
80	

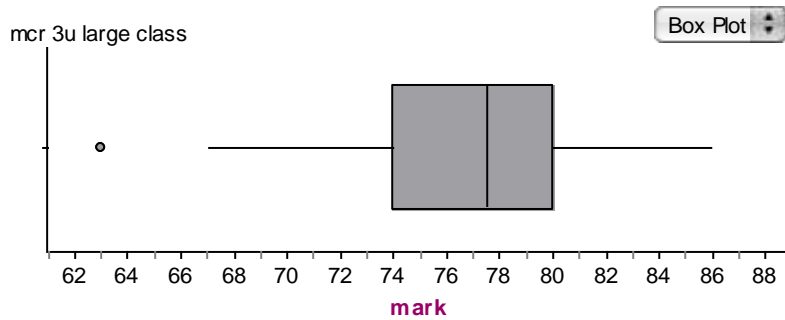
Repeat steps 1 to 4 applied to first data set

$$1. \text{ Range} = 86 - 63 \\ = 23$$

$$2. Q1 = 74, Q2 = 77.5; Q3 = 80$$

$$3. \text{ IQR} = 80 - 74 \\ = 6$$

4.



Note that the minimum is being represented by a point to the far left of the plot. It lies left and beyond  $1.5 \times \text{IQR}$  from the minimum value. That is  $63 < 74 - 1.5(6)$ ;  $63 < 65$ . This 'test' allows one to determine if any value is an *outlier*.

**Task 1:** Compare both 3U classes on the basis of their measures of spread. Write your ideas in the space provided below.

**Class 2 has a smaller IQR (6) with a wide range (23) of scores.**

**Class 1 has a range similar range of scores (25), but a much larger IQR (13).**

**Given the fact that Class 2 has a smaller IQR, 50% of the reported scores lie in closer proximity to the median. This means that class 2 is more consistent in meeting the median score.**