

*Example 1:* B=Blue, G=Green, R=Red and Y=Yellow

Consider a sample: YGBRBBRGYB, picked from a mixed bag. What is the modal colour?

*Solution:* The modal colour is Blue, because it appears most, with a frequency of 4.

### Grouped Data

- For grouped data, we first identify the modal class i.e. the class interval with the highest frequency. The mode lies in this class and then calculate the mode using the formula

$$Mode = \ell + \frac{c(f_1 - f_0)}{2f_1 - f_0 - f_2}$$

Where  $\ell$  is the lower limit of modal class,  $f_1$  is the frequency of the modal class,  $f_0$  is the frequency of the class preceding the modal class,  $f_2$  is the frequency of interval succeeding the modal class and  $c$  is the width of the modal class.

### Example 2:

Find the modal test mark for the following data.

|             |      |       |       |       |       |
|-------------|------|-------|-------|-------|-------|
| Test Mark x | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 |
| Frequency   | 3    | 5     | 7     | 2     | 4     |

**Solution:**

- We seek to invoke the formula

$$Mode = \ell + \left( \frac{c(f_1 - f_0)}{2f_1 - f_0 - f_2} \right)$$

Where 15-20 is the modal class,  $\ell = 15$ ,  $f_1 = 7$ ,  $f_0 = 5$ ,  $f_2 = 2$ , and  $c = 5$

- Substituting yields

$$Mode = 15 + \left( \frac{5(7 - 5)}{2 \times 7 - 5 - 2} \right) = 16.42$$

### Quartiles for ungrouped data

Consider Data from Example 3:

#### Exercise 1: Find $Q_1$ , $Q_2$ and $Q_3$ .

*Solution:*  $Q_1 = 4100$ ,  $Q_2 = 4650$  and  $Q_3 = 5200$

### Quartiles for grouped data

Consider data from Example 4:

#### The Lower Quartile, $Q_1$ :

$Q_1$  position  $\frac{n}{4} = \frac{50}{4} = 12.5^{\text{th}}$  position. Hence  $Q_1$  interval = [10 - 20] because the  $12.5^{\text{th}}$  observation falls within this class interval.

The formula for  $Q_1$  is  $Q_1 = O_{q1} + \frac{c \left[ \frac{n}{4} - F(<) \right]}{f_{q1}}$

Where  $Q_1$  is the Lower Quartile,  $O_{q1}$  is the lower limit of  $Q_1$  Interval (class),  $n$  is the sample size (total number of observations),  $F(<)$  is the cumulative frequency of the interval *before* the  $Q_1$  interval,  $f_{q1}$  is the frequency of the  $Q_1$  interval and  $c$  is the width of the  $Q_1$  interval.

$$\text{Thus: } Q_1 = O_{q1} + \frac{c \left[ \frac{n}{4} - f(<) \right]}{f_{q1}} = 10 + \frac{10 \left[ \frac{50}{4} - 2 \right]}{12} = 18.75$$

*Interpretation:* 25 % of the students got below 18.75marks

#### The Second Quartile, $Q_2$ (Median)

$Q_2$ , use position  $\frac{n}{2} = \frac{50}{2} = 25^{\text{th}}$  position.  $Q_2$  class interval = [20 - 30] because the  $25^{\text{th}}$  observation falls within these limits. The formula for  $Q_2$  is