



Case of tabulated data

The median is calculated in this method according to the following steps:

- Calculated the cumulative ascending or descending repetitive distribution.
- Find the median order by dividing the sum of frequencies by (2).
- Selected the median class of distribution, which is the class that corresponds to the median iteration $\frac{\sum f_i}{2}$ which was calculated in the previous step. So if the median order between two cumulative frequencies, then the median class will be the next class of median order.
- Calculate the value of median by using the following equation

$$M = A + \frac{\frac{\sum f_i}{2} - f_1}{f_2 - f_1} * L$$

M : Median , A : lower limit for median class , $\frac{\sum f_i}{2}$: Median location , f_1 : previous accumulative frequency of the median value , f_2 : next accumulative frequency of the median value , L : The length of median class

Example: Find the Median for the data

Class	Frequency
20-	4
25-	8
30-	16
35-	8
40	4
	$\sum f_i = 40$

Sol.

Length of the frequency	The frequency of cumulative ascending
Less than 20	0
Less than 25	4
Less than 30	12
Less than 35	28
Less than 40	36
Less than 45	40

A

f₁

f₂



$$\frac{\sum f_i}{2} = \frac{40}{2} = 20$$

$$L = 25 - 20 = 5 \text{ or } L = 30 - 25 = 5 \text{ or } L = 35 - 30 = 5$$

$$M = A + \frac{\frac{\sum f_i}{2} - f_1}{f_2 - f_1} * L$$

$$M = 30 + \frac{20 - 12}{28 - 12} * 5$$

$$M = 32.5$$

3- The Mode

Mode is defined as the value that occurs most frequently in the data. Some data sets do not have a mode because each value occurs only once. On the other hand, some data sets can have more than one mode. This happens when the data set has two or more values of equal frequency which is greater than that of any other value

Example 1: Find the mode for the data 15,12,14,16,15,12,16,14

Solution: There are no mode because all values repeat.

Example 2: Find the mode for the data 25, 22, 24, 23, 16, 12

Solution: There are no mode because no values repeat.

Example 3: Find the mode for the data 25, 22, 26, 24, 22, 26, 30, 31

Solution: There are two modes ($M_o = 22, 26$)

- **Case of tabulated data:**

The value of the mode in this case is calculated by using the following equation:

$$M_o = A + \frac{d_1}{d_1 + d_2} * L$$

M_o : the value of the mode

A:the lower value form mode class.

d_1 : frequency of the mode class – frequency of the previous class



Mathematical and Statistics
MSC. Sarai Hamza
First Stage / Second Lector



d_2 : frequency of the mode class – frequency of the next class

L: the length of the mode class

Example: Find the mode for the following data

CLASS	35-40	40-45	45-50	50-55	55-60	60-65	65-70
Frequency	1	2	4	7	5	2	3

$d_1 = 7 - 4$ The value that is most repeated $d_2 = 7 - 5$

Sol:

$$M_o = A + \frac{d_1}{d_1 + d_2} * L$$

$$A = 50$$

$$d_1 = 7 - 4 = 3$$

$$d_2 = 7 - 5 = 2$$

$$L = 55 - 50 = 5$$

$$M_o = 50 + \frac{3}{3 + 2} * 5 = 53$$



Measures of Dispersion

Dispersion is the state of getting dispersed or spread. Statistical dispersion means the extent to which a numerical data is likely to vary about an average value. In other words, dispersion helps to understand the distribution of the data. In statistics, the measures of dispersion help to interpret the variability of data i.e. to know how much homogenous or heterogeneous the data

The types of absolute measures of dispersion are: **Range**, **Quartiles** and **Quartile Deviation**, **Variance**, **Standard Deviation**

Range: It is the simplest measure of dispersion and is defined as the difference between the highest value and the smallest value of the data. If the range is small, the data is confined to a short period, and this means that the data set to be studied is converging, i.e. homogeneous, and on the contrary, if the range is large, it indicates that the data is dispersed

$$\text{Range} = R_{Max} - R_{Min}$$

Example: Find the range for the following data: 4, 25, 26, 15, 20

Solution: $R_{Max} = 26$ and $R_{Min} = 4$

$$\text{Range} = R_{Max} - R_{Min}$$

$$\text{Range} = 26 - 4 = 22$$

Example: Find the range for the following data

class	35-40	40-45	45-50	50-55	55- 60
frequency	1	2	4	7	5

Solution: $R_{Max} = 60$ and $R_{Min} = 35$

$$\text{Range} = R_{Max} - R_{Min}$$

$$\text{Range} = 60 - 35 = 25$$



Quartiles and Quartile Deviation

In statistics, a quartile is a type of quantile which divides the number of data points into four parts, or quarters, of more-or-less equal size. The data must be ordered from smallest to largest to compute quartiles; as such, quartiles are a form of order statistic.

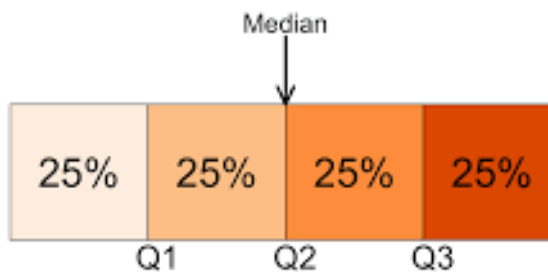
The three main quartiles are as follows:

- The first quartile (Q_1) is defined as the middle number between the smallest number (minimum) and the median of the data set. It is also known as the lower or 25th empirical quartile, as 25% of the data is below this point.
- The second quartile (Q_2) is the median of a data set; thus 50% of the data lie below this point.
- The third quartile (Q_3) is the middle value between the median and the highest value (maximum) of the data set. It is known as the upper or 75th empirical quartile, as 75% of the data lies below this point

$$K_1 = \frac{n+1}{4}, K_2 = \frac{2(n+1)}{4}, K_3 = \frac{3(n+1)}{4}$$

Definition of quartile deviation: one half of the difference obtained by subtracting the first quartile from the third quartile in a frequency distribution

$$Q.D = \frac{Q_3 - Q_1}{2}$$





Example: Find the quartiles for the following numbers 100, 150, 200, 50, 160, 300, 250

Solution: 50, 100, 150, 160, 200, 250, 300

$$K_1 = \frac{n+1}{4} = \frac{7+1}{4} = \frac{8}{4} = 2, Q_1 = 100$$

$$K_2 = \frac{2(n+1)}{4} = \frac{2(7+1)}{4} = \frac{16}{4} = 4, Q_2 = 160$$

$$K_3 = \frac{3(n+1)}{4} = \frac{3(7+1)}{4} = \frac{3 \cdot 8}{4} = 6, Q_3 = 250$$

Example: A year ago, Angela began working at a computer store. Her supervisor asked her to keep a record of the number of sales she made each month. The following data set is a list of her sales for the last 12 months: **34, 47, 1, 15, 57, 24, 20, 11, 19, 50, 28, 37**.

Use Angela's sales records to find: The quartiles and quartile deviation, the range

Solution: The values in ascending order are: 1, 11, 15, 19, 20, 24, 28, 34, 37, 47, 50, 57.

$$K_1 = \frac{n+1}{4} = \frac{12+1}{4} = \frac{13}{4} = 3.25, Q_1 = \frac{15+19}{2} = 17$$

$$K_2 = \frac{2(n+1)}{4} = \frac{2(12+1)}{4} = \frac{26}{4} = 6.5, Q_2 = \frac{24+28}{2} = 26$$

$$K_3 = \frac{3(n+1)}{4} = \frac{3(12+1)}{4} = \frac{39}{4} = 9.75, Q_3 = \frac{37+47}{2} = 42$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{42 - 17}{2} = 25$$

$$\text{Range} = R_{Max} - R_{Min} = 57 - 1 = 56$$

