Median.

Median is defined as the value of an item or observation above or below which lies on an equal number of observations i.e., the median is the central value of the set of observations provided all the observations are arranged in the ascending or descending orders.

(1) **Calculation of median**

(i) **Individual series:**If the data is raw, arrange in ascending or descending order. Let n be the number of observations.

If n is odd,   Median = value of $\left(\dfrac{n+1}{2}\right)^{th}$ item.

If n is even, Median = $\dfrac{1}{2}\left[\text{value of}\left(\dfrac{n}{2}\right)^{th} \text{item} + \text{value of}\left(\dfrac{n}{2}+1\right)^{th} \text{item}\right]$

(ii) **Discrete series:**In this case, we first find the cumulative frequencies of the variables arranged in ascending or descending order and the median is given by

Median = $\left(\dfrac{n+1}{2}\right)^{th}$ observation, where n is the cumulative frequency.

(iii) **For grouped or continuous distributions:**In this case, following formula can be used

(a) For series in ascending order, Median = $l + \dfrac{\left(\dfrac{N}{2} - C\right)}{f} \times i$

Where l = Lower limit of the median class

      f = Frequency of the median class

      N = The sum of all frequencies

      I = The width of the median class

      C = The cumulative frequency of the class preceding to median class.

(b) For series in descending order

Median = $u - \left(\dfrac{\dfrac{N}{2} - C}{f}\right) \times i$, where u = upper limit of the median class

$$N = \sum_{i=1}^{n} f_i$$

As median divides a distribution into two equal parts, similarly the quartiles, quantiles, deciles and percentiles divide the distribution respectively into 4, 5, 10 and 100 equal parts. The jth

quartile is given by $Q_j = l + \left(\dfrac{j\dfrac{N}{4} - C}{f} \right) i; j = 1, 2, 3$. Q_1 is the lower quartile, Q_2 is the median and

Q_3 is called the upper quartile.

(2) **Lower quartile**

(i) **Discrete series:** $Q_1 = \text{size of} \left(\dfrac{n+1}{4} \right)^{th} \text{item}$

(ii) **Continuous series:** $Q_1 = l + \dfrac{\left(\dfrac{N}{4} - C \right)}{f} \times i$

(3) **Upper quartile**

(i) **Discrete series:** $Q_3 = \text{size of} \left[\dfrac{3(n+1)}{4} \right]^{th} \text{item}$

(ii) **Continuous series:** $Q_3 = l + \dfrac{\left(\dfrac{3N}{4} - C \right)}{f} \times i$

(4) **Decile:** Decile divide total frequencies N into ten equal parts.

$$D_j = l + \frac{\frac{N \times j}{10} - C}{f} \times i \quad [j = 1, 2, 3, 4, 5, 6, 7, 8, 9]$$

If j = 5, then $D_5 = l + \frac{\frac{N}{2} - C}{f} \times i$. Hence D_5 is also known as median.

(5) **Percentile:** Percentile divide total frequencies N into hundred equal parts

$$P_k = l + \frac{\frac{N \times k}{100} - C}{f} \times i$$

where k = 1, 2, 3, 4, 5,.......,99.