

$$M_c = L_m + \frac{\frac{N}{2} - F'_m}{f_m} \times h$$

where,

L_m = lower limit of the median class.

N = total frequency

f_m = frequency of the median class

F'_m = cumulative frequency of the pre-median class

h = length of median class.

Advantages of Median :

- It is rigidly defined.
- It is easily understood and easy to compute.
- It is not influenced by extreme items.
- It can be calculated for distribution with opened classes.
- It can be used in defining the median of attributes.

Disadvantages of Median :

- It is not based upon all the observations.
- It is not suitable for further algebraic treatment.
- It is affected much by the sampling fluctuation.

Uses of Median :

- It is used in case of both quantitative and qualitative data.
- It is used for calculating the typical value in problem concerning wages, distribution of wealth etc.

3.5 Quantiles : Quantiles also are some positional or location measures of the distribution. Quantiles are those values in a series which divide the whole distribution into a number of equal parts when the series is arranged in order of magnitude of observations. The following are the quantiles that are used in Statistics -

1) Quartiles (2) Deciles and (3) Percentiles.

3 quartiles : Q_i ($i = 1, 2, 3$); divide the whole distribution into four equal parts

9 Deciles : D_j ($j = 1, 2, \dots, 9$); divide the whole distribution into 10 equal parts.

99 Percentiles : P_k ($k = 1, 2, \dots, 99$); divide the whole distribution into 100 equal parts.

Computation of quantiles from frequency distribution is very much similar to that of median. We first need to identify the corresponding quantile class. The classes having cumulative frequencies equal to or immediately higher than $iN/4$, $jN/10$ and $kN/100$ are respectively the i th quartile class, the j th decile class and the k th percentile class.

For frequency distributions the quantiles are computed as -

$$Q_i = L_i + \frac{\frac{iN}{4} - F'_i}{f_i} \times h; \quad i = 1, 2, 3$$

$$D_j = L_j + \frac{\frac{jN}{10} - F'_j}{f_j} \times h; \quad j = 1, 2, \dots, 9$$

$$P_k = L_k + \frac{\frac{kN}{100} - F'_k}{f_k} \times h; \quad k = 1, 2, \dots, 99$$

i, j, k indicate the order of quartiles, deciles and percentiles respectively; F'_i, F'_j and F'_k are respectively the cumulative frequencies of class preceding the i th quartile, j th decile and k th percentile classes; h is the corresponding class interval.

It may be mentioned that

$$Q_2 = D_5 = P_{50} = M_e; \quad Q_1 = P_{25}; \quad Q_3 = P_{75}; \quad D_6 = P_{60} \text{ etc.}$$

Graphical Location of Median and Quantiles :

Median, quartiles, deciles and percentiles can be located from ogive; the necessary steps are briefly discussed below :

- An ogive is drawn and the position in the Y-axis are marked for different partition values (e.g., $N/2$ for median, $N/4$ for 1st quartile, $4N/10$ for 4th decile etc.)
- From the corresponding points in the Y-axis, a line parallel to the X-axis is drawn which intersects the ogive at certain point.
- From the corresponding point of intersection mentioned above, a perpendicular is drawn on the X-axis; the foot of the perpendicular is the desired partition value. The whole process is illustrated in figure 3.1 below :

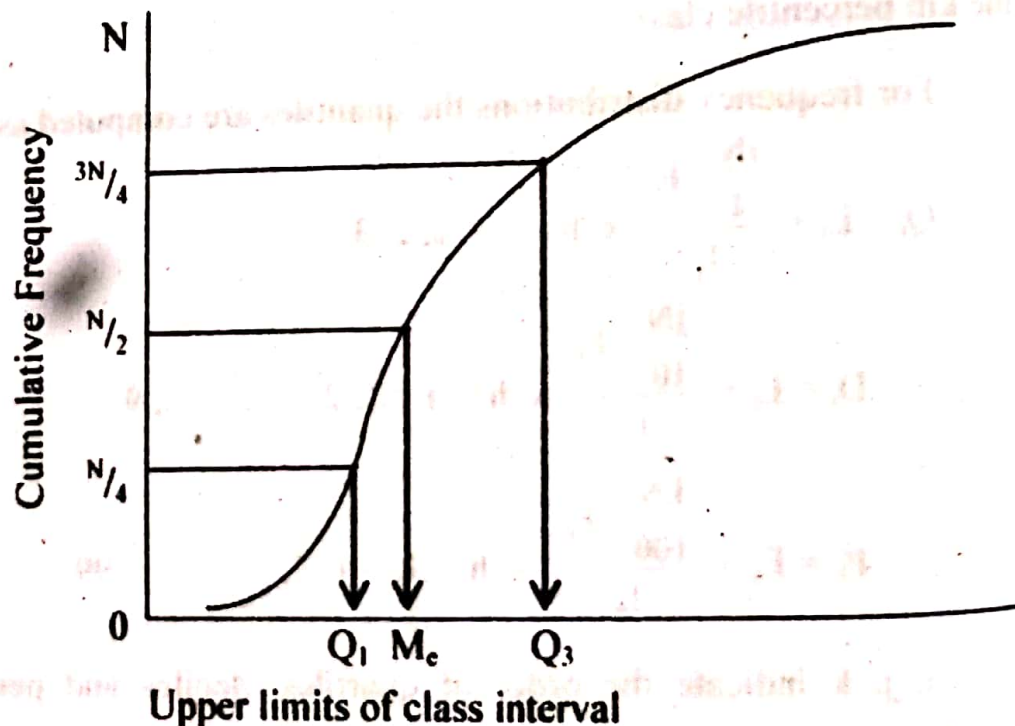


Fig. 3.1: Location of median and quantiles.

3.6. Mode (M_o) :

Mode of the distribution is that value of the variate for which the frequency is the maximum. In other words, mode is the highest

frequent value of a distribution. In the case of frequency distribution, mode is given by

$$M_0 = L + \frac{f_0 - f_1}{2f_0 - f_1 - f_2} \times h$$

where, L = lower limit of modal class

f_0 = frequency of modal class

f_1 = frequency of pre-modal class

f_2 = frequency of post-modal class

[The class which corresponds to the maximum frequency is the model class]

Advantages of Mode :

- It is easy to understand and easy to calculate
- It is not affected by extreme values.
- It can be located graphically.

Disadvantages of Mode :

- It is not rigidly defined - a distribution may have more than one mode.
- It is not based upon all the observations.
- It is not suitable for further algebraic treatment.

Uses of Mode :

- Mode is used to find the ideal size, e.g., in business forecasting, Meteorological forecast on weather condition, in the manufacture of ready-made garments, shoes, etc.

Graphical Location of Mode :

Mode can graphically located in two ways::

- a) Using frequency curve.
- b) Using the histogram.

- a) From the peak of the frequency curve, a perpendicular is drawn on the X-axis; the foot of the perpendicular indicates the mode (shown in figure 3.2) :

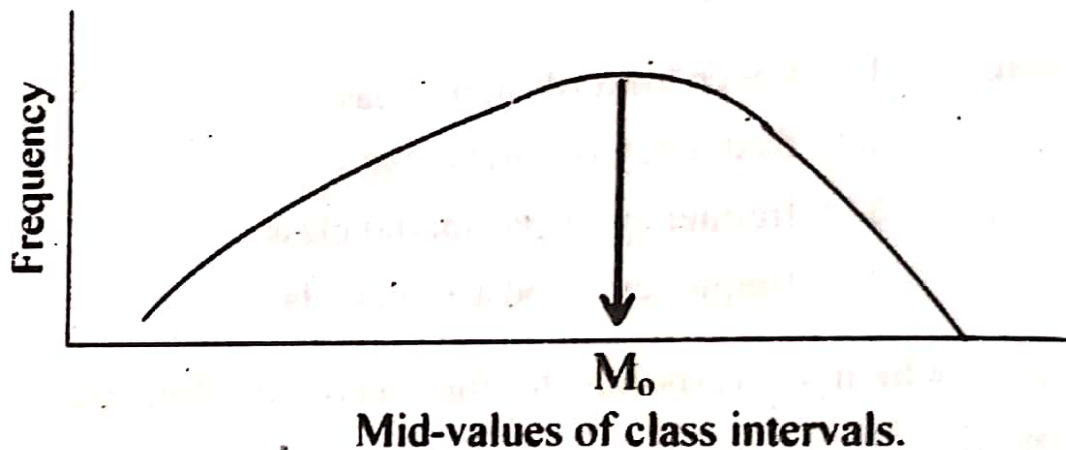


Fig. 3.2: Location of mode from frequency curve

- b) Mode can be located more accurately from the histogram; the steps are the following :
- i) The rectangles corresponding to the modal group, the pre-modal group and the post-modal group are considered. A straight line is drawn connecting the left vertical point (say A) of the modal group rectangle and the left vertical point (say D) of the post modal group rectangle. Similarly the right vertical point (say B) of the modal group rectangle and the right vertical point (say C) of the pre-modal group rectangle are connected.
 - ii) From the point of intersection of AD and BC, a perpendicular is drawn on the X-axis; the foot of the perpendicular indicates mode.

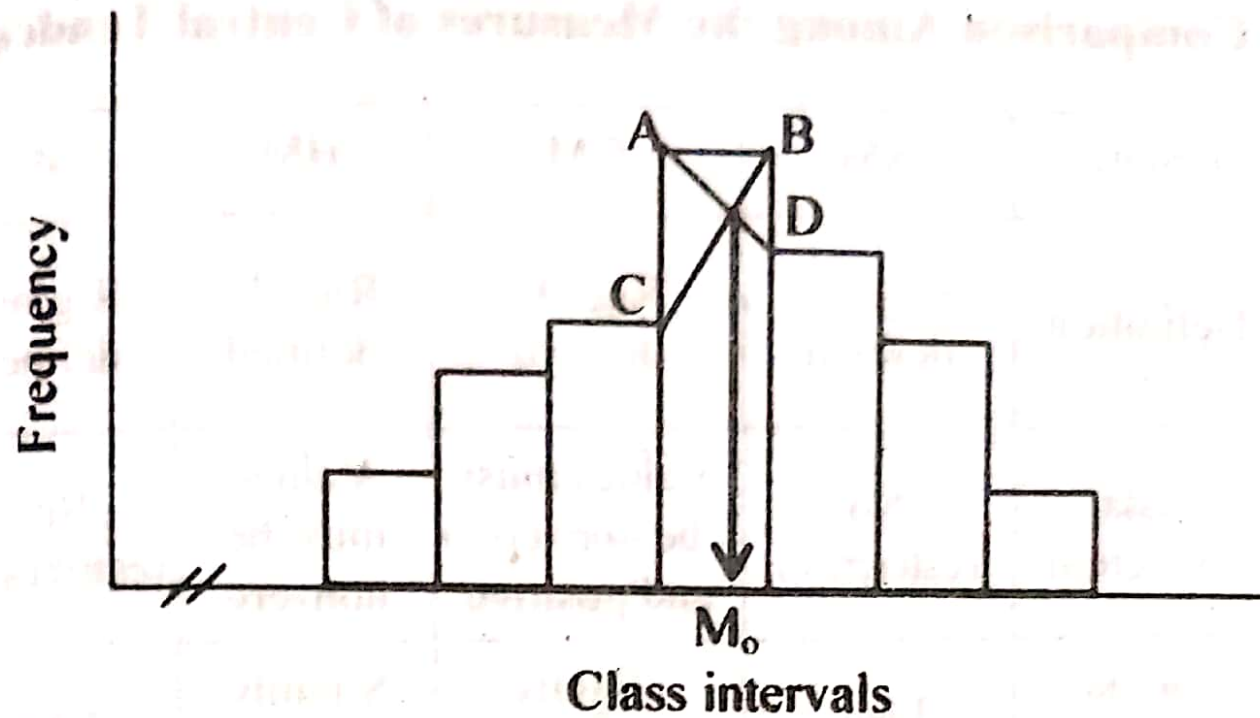


Fig. 3.3: Location of mode from the histogram.

Comparison Among the Measures of Central Tendency

Criteria	AM	GM	HM	M_e	M_o
Definition	Rigidly defined	Rigidly defined	Rigidly defined	Rigidly defined	Not rigidly defined
Data restriction	No restriction	Values must be nonzero and positive	Values must be nonzero	No restriction	No restriction
Computation	Easy	Slightly difficult	Slightly difficult	Easy	Easy
Based upon all observations	Yes	Yes	Yes	No	No
Effect of extreme values	Less affected	Not affected	Less affected	Not affected	Not affected
Sampling fluctuation	Little	Little	Little	Much	Much
Graphical location	Not possible	Not possible	Not possible	Possible	Possible
Further algebrical treatment	Possible	Possible	Not possible	Not possible	Not possible

From the above comparison, it is clear that arithmetic mean is the best measure of central tendency.