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Basic Concepts

1. The mean $\bar{x}$ of n values $x_1, x_2, x_3, \dots\dots, x_n$ is given by

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \dots\dots + x_n}{n}$$

2. Mean of grouped data (without class – intervals)

(i) **Direct Method:** If the frequencies of n observations $x_1, x_2, x_3, \dots\dots, x_n$ be $f_1, f_2, f_3, \dots\dots, f_n$ respectively, then the mean $\bar{x}$ is given by

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \dots\dots\dots + f_nx_n}{f_1 + f_2 + f_3 + \dots\dots\dots + f_n} = \frac{\Sigma \mathrm{f_i} x_i}{\Sigma \mathrm{f_i}}$$

(ii) Deviation Method or Assumed Mean Method

In this case, the mean $\bar{x}$ is given by $\bar{x} = a + \frac{\Sigma \mathrm{f_i}(x_i - a)}{\Sigma \mathrm{f_i}} = a + \frac{\Sigma \mathrm{f_i} d_i}{\Sigma \mathrm{f_i}}$

where, a = assumed mean, Σf_i = total frequency, $d_i = x_i - a$,
$\Sigma f_i(x_i - a)$ = sum of the products of deviations and corresponding frequencies.

3. Mean of grouped data (with class – intervals)

In the case the class marks are treated as x_i

Class mark = $\frac{Lower\ class\ limit + Upper\ class\ limit}{2}$

(i) Direct Method

If the frequencies corresponding to the class marks $x_1, x_2, x_3, \dots\dots, x_n$ be $f_1, f_2, f_3, \dots\dots, f_n$ respectively, then mean $\bar{x}$ is given by

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \dots\dots + f_nx_n}{f_1 + f_2 + f_3 + \dots\dots + f_n} = \frac{\Sigma \mathrm{f_i} x_i}{\Sigma \mathrm{f_i}}$$

where, a = assumed mean, Σf_i = total frequency, $d_i = x_i - a$

(ii) Deviation or Assumed Mean Method

In this case the mean $\bar{x}$ is given by $\bar{x} = a + \frac{\Sigma \mathrm{f_i} d_i}{\Sigma \mathrm{f_i}}$

where, a = assumed mean, Σf_i = total frequency and $d_i = x_i - a$

(iii) Step deviation method

In this case we use the following formula

$$\bar{x} = a + \frac{\Sigma \mathrm{f_i}\left(\frac{x_i - a}{h}\right)}{\Sigma \mathrm{f_i}} \times h = a + h\left(\frac{\Sigma \mathrm{f_i} u_i}{\Sigma \mathrm{f_i}}\right),$$

where, $a =$ assumed mean, $\Sigma f_i =$ total frequency, $h =$ class size,

$$u_i = \frac{x_i - a}{h}$$

4. Mode is that value among the observations which occurs most often i.e., the value of the observation having the maximum frequency.
5. If in a data more than one value have the same maximum frequency, then the data is said to be multi – modal.
6. In a grouped frequency distribution, the class which has the maximum frequency is called the modal class.
7. We use the following formula to find the mode of a grouped frequency distribution.

Mode (M_0) = $l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$, where

$l =$ lower limit of modal class

$h =$ size of the class interval

$f_1 =$ frequency of the modal class

$f_0 =$ frequency of the class preceding the modal class

$f_2 =$ frequency of the class succeeding the modal class

8. Median is the value of the middle most item when the data are arranged in ascending or descending order of magnitude.

9. Median of ungrouped data

(i) If the number of items n in the data is odd, then

Median = value of $\left(\frac{n+1}{2}\right)$th item.

(ii) If the total number of items n in the data is even, then

Median = $\frac{1}{2}\left[value\ of\ \frac{n}{2}\ th\ item + value\ of\ \left(\frac{n}{2} + 1\right)\ th\ item\right]$

10. Cumulative frequency of a particular value of the variable (or class) is the sum total of all the frequencies up to that value (or the class).
11. There are two types of cumulative frequency distributions.

(i) cumulative frequency distribution of less than type.

(ii) cumulative frequency distribution of more than type.

12. **Median of grouped data with class – intervals**

In this case, we first find the half of the total frequencies, i.e., $\frac{n}{2}$. The class in which $\frac{n}{2}$ lies is called the median class and the median lies in this class.

We use the following formula for finding the median

Median(M_e) = $l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$, where

$l =$ lower limit of the median class

$n =$ number of observations

$cf =$ cumulative frequency of the class preceding the median class

$f =$ frequency of the median class

$h =$ class size

13. The three measures mean, mode and median are connected by the following relations:

    Mode = 3 median – 2 mean

    or median = $\frac{mode}{3} + \frac{2\ mean}{3}$ or mean = $\frac{3\ median}{2} - \frac{mode}{2}$

14. The graphical representation of a cumulative frequency distribution is called an ogive or cumulative frequency curve.
15. We can draw two types of ogives for a frequency distribution. These are less than ogive and more than ogive.
16. For less than ogive, we plot the points corresponding to the ordered pairs given by (upper limit, corresponding less than cumulative frequency). After joining these points by a free hand curve, we get an ogive of less than type.
17. For more than ogive, we plot the points corresponding to the ordered pairs given by (lower limit, corresponding more than cumulative frequency). After joining these points by a free hand curve, we get an ogive of more than type.
18. Ogive can be used to estimate the median of the data. There are two methods to do so.

    First method: Mark a point corresponding to $\frac{n}{2}$, where n is the total frequency, on cumulative frequency axis (y – axis). From this point, draw a line parallel to $x -$ axis to cut the ogive at a point. From this point, draw a line perpendicular to the $x -$ axis to get another point. The abscissa of this point gives median.

Second method: Draw both the ogives (less than ogive and more than ogive) on the same graph paper which cut each other at a point. From this point, draw a line perpendicular to the $x -$ axis, to get another point. The abscissa of this point gives median.