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Lecture No-32

MEAN.

Measure of central tendency i.e. average gives the whereabout of some central value of a series, around which all other observations are dispersed.

Various types of central tendency may be kept under two major heads.

(I) Mathematical average and
(II) Averages of Position.

(I) Mathematical average :- Averages represented purely in mathematical value is known as mathematical averages. It is of 3 types: (1) Arithmatic mean
(2) Geometric mean
(3) Harmonic mean.

(II) Averages of Position – Mean exhibited by position is called averges of Position. It is of two types (I) Median &
(II) Mode.

Arithmatic Mean

Central value or average obtained arithmatically is known as arithmatic mean. It is calculated by summing up all observations of a series & deviding it by the number of observations.

Mean can be calculated from ungrouped (individual series) and grouped (discrete & continuous) data.

(I) Ungrouped (Individual series) :- The summation of all values of variables in individual observation divided by the number of observations is the mean of that individual series.

Ex- Suppose each individual observation is $X_1, X_2 X_3 \cdots X_n$
Summation of all observation is ΣX. Then ~~$\Sigma X = X_1 X_2 X_3$~~

Then $\Sigma X = X_1 + X_2 + X_3 \cdots X_n$. The number of observation is N. Therefore the arithmatic mean can be calculated by the following formula.

$$\bar{X} = \frac{\Sigma X}{N} \text{ (Direct method)}$$

$$\bar{X} = \omega + \frac{(\Sigma dx')}{N} \text{ (Short cut method).}$$

Where $\bar{X}$ = Mean
ΣX = Summation of all observations
N = Total No. of Observations
$\Sigma dx'$ = Summation of deviations of variables obtained from assumed mean.

Example :- Length of 10 Earthworms in a small garden were measured as follows. Find out the mean length of Earthworm.

Serial No. of Earthworm : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
Lt. of Earthworms in cms : 6, 7, 5, 4, 8, 7, 9, 6, 8, 7.

Calculation by direct method :-

$$\bar{X} = \frac{\Sigma X}{N}, \quad \bar{X} = \frac{6+7+5+4+8+7+9+6+8+7}{10} = \frac{67}{10} = 6.7 \text{ cm Ans.}$$

(b) Calculation by short cut method :- Here three columns have been made. First column bear Serial No. of Earthworms. Second column have length of earthworms & Third column bear deviation from assumed mean.

Sl. No.	Length in cms X	Deviation from assumed Mean (dx)
1	6	6 - 8 = -2
2	7	7 - 8 = -1
3	5	5 - 8 = -3
4	4	4 - 8 = -4
5	8 (ω)	8 - 8 = 0
6	7	7 - 8 = -1
7	9	9 - 8 = +1
8	6	6 - 8 = -2
9	8	8 - 8 = 0
10	7	7 - 8 = -1
N = 10		$\Sigma dx' = -13$

Where w = Assumed mean. Here $w = 8$

Formula for short-cut Method to get mean:

$$\bar{X} = w\left(\frac{\Sigma dx'}{N}\right) = 8 + \frac{-13}{10} = 8 + (-1.3) = 6.7 \text{ cms. Ans.}$$

Grouped data - When data is in frequency distribution.

(A) Discrete Series = Mean in discrete series can be obtained by two methods (I) Direct method & (II) Short-cut method.

(I) Direct Method :- Summation of variables multiplied by their respective frequencies divided by the total no. of observations is the direct method to obtain mean in discrete series.

$$\bar{X} = \frac{f_1x_1 + f_2x_2 + f_3x_3 \cdots f_nx_n}{f_1 + f_2 + f_3 \cdots f_n}$$

$$\bar{X} = \frac{\Sigma fx}{\Sigma f} \text{ (Direct method}$$

Here $x_1, x_2, x_3 \cdots x_n$ are observations & their respective frequencies are $f_1, f_2, f_3 \cdots f_n$. Summation of observations multiplied by their respective frequencies is Σfx. Then $\Sigma fx = f_1x_1 + f_2x_2 + f_3x_3 \cdots f_nx_n$.

Length of fishes = 5, 15, 25, 35, 45, 55, 65, 75

Frequency = 3, 11, 7, 4, 10, 5, 7, 3.

$\therefore \Sigma fx = f_1x_1 + f_2x_2 + f_3x_3 \cdots f_nx_n$.

$\therefore \Sigma fx = 5\times3 + 15\times11 + 25\times7 + 35\times4 + 45\times10 + 55\times5 + 65\times7 + 75\times3 = 1900$.

$\therefore \bar{X} = \frac{\Sigma fx}{\Sigma f}$ Here $\Sigma fx = 1900$ & $\Sigma f = 50$

$\therefore \bar{X} = \frac{1900}{50} = 38$ cm. Ans.

(II) Short-cut method :- Formula is $\bar{X} = w + \frac{\Sigma f \cdot dx}{\Sigma f}$.

where $\bar{X}$ - stands for mean.

w - stands for value of assumed mean.

$\Sigma f dx'$ - stands for summation of deviations obtained from assumed mean & multiplied by their frequencies.

Σf - stands for total number of observations.

Length of fish x	Frequency f	Deviation from assumed mean dx' (45)	Frequency deviation f dx'
5	3	5-45 = -40	-120
15	11	15-45 = -30	-330
25	7	25-45 = -20	-140
35	4	35-45 = -10	-40 = -650
45 (w)	6	45-45 = 0	0
55	5	55-45 = +10	+50
65	7	65-45 = +20	+140
75	3	75-45 = +30	+90 I 230
	Σf = 50		Σfdx' = -400

$\therefore \bar{x} = w + \frac{\Sigma f dx'}{\Sigma f}$, Here $N = 45$. $\Sigma f dx' = -400$, $\Sigma f = 50$.

$\therefore \bar{x} = 45 + \frac{-400}{50} = 45 + (-8) = 45 - 8 = 37$ cms Ans.

(2) Grouped data (B) continuous Series – Mean is calculated in continuous series like discrete series with slight variation.

(a) Direct Method :- Mid value of each class interval is obtained by

$$\text{Mid value} = \frac{\text{Lower level of CI} + \text{upper level of CI}}{2}$$

After obtaining ~~lower~~ mid value of each class interval continuous series is converted to discrete series & formula used as $\bar{x} = \frac{\Sigma f.dx}{\Sigma f}$ (Direct method)

(b) Shot cut Method :- The same formula used in discrete series is applied to width of class interval. $\bar{x} = w + \frac{\Sigma f.dx'}{\Sigma f} . j$.

where w = Stands for assumed mean.

j = Stands for width of class interval.

dx' = Stands for deviation obtained from assumed Mean

Σf = Stands for total No. of observations.

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