STATISTICS

~~OR measure of central tendency~~

☆ Measure of Dispersion

① Mean deviation ② Variance ③ Standard deviation.

1) Mean deviation

↳ It is the average of the deviations of the data from a Central value.

↳ It is of two types (Generally)

i) Mean deviation about mean, ii) Mean deviation about median

i) Mean deviation about mean

Case-I → for discrete data.

① steps → (i) Find mean of data

$$\bar{x} = \frac{\text{Sum of observations}}{\text{No. of " "}} = \frac{\sum x_i}{N}$$

→ ~~then~~ (ii) Find deviations $d_i = |x_i - \bar{x}|$

(iii) Find mean deviation about mean

$$M.D.(\bar{x}) = \frac{\sum d_i}{N} = \frac{\sum |x_i - \bar{x}|}{N}$$

Case-II → for discrete frequency distribution

↳ In this case we are given the values of observation and their frequency.

Steps

(i) Find mean of the data

$$\bar{x} = \frac{\sum x_i f_i}{\sum f_i}$$

(ii) then find deviations

$$d_i = |x_i - \bar{x}|$$

(iii) find mean deviation about mean

$$M.D.(\bar{x}) = \frac{\sum f_i d_i}{\sum f_i}$$

Case-II ⇒ Continous frequency distribution

↳ In this case we are not given the value of observations but the interval of the observation & their corresponding frequencies. So, we assume the observations as mid points of the interval then proceed as in Case-II.

Q). find mean deviation about mean of the following data sets

i). 2, 8, 13, 15, 6., 17, 5, 13, 11, 10

A ⇒

total 100

$$\bar{x} = \frac{100}{10} = 10$$

$$d_i = |x_i - \bar{x}|$$

d_i = 8, 2, 3, 5, 4, 7, 5, 3, 1, 0

$$M.D.(\bar{x}) = \frac{38}{10} = 3.8$$

ii)

x_i	f_i	$d_i = \lvert x_i - 7.5 \rvert$	$f_i x_i$	$f_i d_i$
2	2	5.5	4	11
5	8	2.5	40	20
6	10	1.5	60	15
8	7	0.5	56	3.5
10	8	2.5	80	20
12	5	4.5	60	22.5

$$\bar{x} = \frac{300}{40} = 7.5$$

$$M.D.(\bar{x}) = \frac{92}{40} = 2.3$$

☆ Sum of mean of First n natural no's $1, 2, 3, 4, \ldots n$

$n\left(\frac{n+1}{2}\right)$

$$\bar{x} = \frac{n\left(\frac{n+1}{2}\right)}{n}$$

$$\boxed{\bar{x} = \frac{n+1}{2}}$$

iii)

C.I.	f_i	x_i	x_i	$x_i f_i$	d_i	$f_i d_i$	$a_i = x_i - A$	$a_i f_i$
0 - 10	5	25	5	25	35	175	~~-150~~ -30	-150
10 - 20	7	105	15	105	25	175	-20	-140
20 - 30	8	200	25	200	15	120	-10	-80
30 - 40	10	350	35	350	5	50	0	0
40 - 50	10		45	450	5	50	10	100
50 - 60	8		55	440	15	120	20	160
60 - 70	7		65	455	25	175	30	210
70 - 80	5		75	375	35	175	40	200
	$\Sigma = 60$			$= 2400$		1040		

$$\bar{x} = \frac{2400}{60} = 40$$

$$\bar{x} = \frac{\sum a_i f_i}{\sum f_i} + A \quad \rightarrow a_i = x_i - A$$

↳ Assumed mean method.

$$MD.(\bar{x}) = \frac{\overset{52}{\cancel{1040}}}{\cancel{60}\ 3} = \frac{52}{3}$$

$$\bar{x} = h\frac{\sum a_i f_i}{\sum f_i} + A \quad \rightarrow a_i = \frac{x - A}{h}$$

↳ class size

↳ Step deviation method & $(10-0) = h$ e.g

iv)

C.I.	f_i	x_i	$u_i = \frac{x_i - a}{h}$	$f_i u_i$	$d_i = \lvert x_i - \bar{x} \rvert$	$f_i d_i$
95-105	9	100	-2	-18	25.3	227.7
105-115	13	110	-1	-13	15.3	198.9
115-125	26	120	0	0	5.3	137.8
125-135	30	130	1	30	5.3	141.0
135-145	12	140	2	24	15.3	176.4
145-155	10	150	3	30	25.3	247.0
	$\Sigma f_i = 100$			$\Sigma f_i u_i = 53$		$= 1128.0$

$h = 10$

$$\bar{x} = h \frac{\Sigma f_i u_i}{\Sigma f_i} + a$$

$$= 10 \times \frac{53}{100} + 120$$

$$\bar{x} \Rightarrow 125.3$$

$$M.D.(\bar{x}) = \frac{1128.0}{100}$$

$$= 11.288 \text{ Ans.}$$