Mean Deviation

Mean Deviation is defined as the average of the sum of deviation of absolute values from their mean

Mean Deviation for the not tabulated data (ungrouped data): $\boldsymbol{M.D = \frac{\sum|x_i - \bar{X}|}{n}}$

Example: find the mean deviation of the following data 11, 12, 13, 12, 13, 11

Sol: $\bar{X} = \frac{\sum x_i}{n} = \frac{11+12+13+12+13+11}{6} = 12$

$M.D = \frac{\sum|x_i - \bar{X}|}{N} = \frac{4}{6} = 0.666$

x_i	$\lvert x_i - \bar{X}\rvert$
11	1
12	0
13	1
12	0
13	1
11	1
Sum.	4

Mean deviation for the tabulated data (grouped data): $\boldsymbol{M.D = \frac{\sum f_i|x_i - \bar{X}|}{n}}$

Example: find the mean deviation of the following data, which represents the distribution of college of pharmacy student by weight

class	60-62	63-65	66-68	69-71	72-74
frequency	5	15	45	27	8

Sol:

class	frequency	x_i	$x_i f_i$	$\lvert x_i - \bar{X}\rvert$	$f_i\lvert x_i - \bar{X}\rvert$
60-62	5	61	305	6.54	32.7
63-65	15	64	960	3.54	53.1
66-68	45	67	3015	0.54	24.3
69-71	27	70	1890	2.46	66.42
72-74	8	73	584	5.46	43.68
sum	100		6754		220.2

$\boldsymbol{M.D = \frac{\sum f_i|x_i - \bar{X}|}{n}}$, $\bar{X} = \frac{\sum f_i x_i}{\sum f_i} = \frac{6754}{100} = 67.54$

$$M.D = \frac{\sum f_i|x_i - \bar{X}|}{n} = \frac{220.2}{100} = 2.202$$

Variance, Standard Deviation

It is a measurement of the spread between data set and denoted by S^2 .The formula for variance is:

For not tabulated data use the $S^2 = \frac{\sum(x_i - \bar{X})^2}{n}$, S: standard deviation

For tabulated data use the $S^2 = \frac{\sum f_i(x_i - \bar{X})^2}{\sum f_i}$

Example: Find the variance and standard deviation for 24, 25, 26, 27, 28

Solution:

$$\bar{X} = \frac{\sum x_i}{n} = \frac{24+25+26+27+28}{5}$$
$$= \frac{130}{5} = 26$$

x_i	$x_i - \bar{X}$	$(x_i - \bar{X})^2$
24	-2	4
25	-1	1
26	0	0
27	1	1
28	2	4
$\sum x_i = 130$	0	10

$$S^2 = \frac{\sum(x_i - \bar{X})^2}{n} = \frac{10}{5} = 2$$

$$S = \sqrt{S^2} = \sqrt{2} = 1.414$$

Coefficient of variation

It is used to show the effect of the change in the relation to other statistics, in addition to obtaining a non-dimensional coefficient from the ratio of the standard deviation to the mean, and denoted by C. V

$$C.V = \frac{S}{\bar{\bar{X}}}$$

Coefficient of Quartile Variation: it is known by this equation:

$$C_{q.v.} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

Example: In a detailed study to find number of patients with COVID -19 within specific, it is found:

Age No.of patient	No.of patient
10-19	20
20-29	48
30-39	51
40-49	30
50-59	26
60-69	9

Find Coefficient of variation

Sol.

Age	f_i	x_i	$f_i x_i$	$x_i - \bar{X}$	$(x_i - \bar{X})^2$	$((x_i - \bar{X})^2) f_i$
10-19	20	14.5	290	-21.14	446.9	8938
20-29	48	24.5	1176	-11.14	124.1	5956.8
30-39	51	34.5	1759.5	-1.14	1.3	66.3
40-49	30	44.5	1335	8.86	78.5	2355
50-59	26	54.4	1417	18.86	355.7	9248.2
60-69	9	64.5	580.5	28.86	832.9	7496.1
Summation	184		6558			34060.4

$$\bar{X} = \frac{\sum f_i x_i}{\sum f_i} = \frac{6558}{184} = 35.64$$

$$S^2 = \frac{\sum f_i (x_i - \bar{X})^2}{\sum f_i} = \frac{34060.4}{184} = 185.11$$

$$S = \sqrt{S^2} = \sqrt{185.11} = 13.6$$

$$C.V = \frac{S}{\bar{X}} = \frac{13.6}{35.64} = 0.38$$