

1. Mode : it is the most frequent observation in data , if data have one mode (unimodal)

Two mode (bi modal) three mode (trimodal), data have no mode (no modal).

Example: ages for 20 persons

37,31,36,34,32,31,30,27,30,30,30,27,28,28,28,29,29,29,29,30. Find mode?

27 27 28 28 28 29 29 29 29 30 30 30 30 30 31 31 32 34 36 37

30 mode uni modal

في حالة رقم ٢٩ تكرر ٥ مرات هذا سوف يكون

Bi modal 30 – 29 mode

Example:-

Find mode value of fasting blood sugar for the following cases.

Cases	1	2	3	4	5	6	7	8	9	10
FBS (mg/dl)	195	184	138	94	261	191	112	184	94	94

Mode = 94 mg/dl is the highest frequency in a set of values. unimodal

2. Measures of dispersion

It gives the clear concept about the scatterness of the data (precision).

Data may have same central value but different dispersion.

(Range – standard deviation – variance – coefficient of variance)

Range: is the difference between the largest and smallest value, it is simple to calculate but does not give idea about number in between

$R = X_L - X_S$ X_L : largest value X_S : Smallest value

Example: what is range of ages of the sample subjects?

Obs.\ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Age\ 30 43 45 48 50 63 68 76 71 77 82 71 44 47 52 38

$R = X_L - X_S \implies R = 82 - 30 \implies R = 52$

Standard deviation: a statistical measure of the average deviation of data from the mean value

Variance : the square of the standard deviation

Standard deviation	$s = \sqrt{s^2} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	Range	$R = x_L - x_s$
Coefficient of variation	$C.V. = \frac{s}{\bar{x}}(100)\%$	Sample variance	$s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}$
		Population variance	$\sigma^2 = \frac{\sum_{i=1}^N (x_i - \mu)^2}{N}$

Example:-

Calculate variance and standard deviation values for the below set of data.

Case	1	2	3	4	5	6	7	8	9	10
HbA1c%	8.4	9.5	6.3	7.4	8.3	6.7	10.2	8.1	7.8	6.9

Solution:-

Mean (x) = $\sum x_i / n$

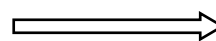
Mean (x) = $\frac{8.4 + 9.5 + 6.3 + 7.4 + 8.3 + 6.7 + 10.2 + 8.1 + 7.6 + 6.5}{10}$

Mean (x) = 7.9

Cases	HbA1c %	(x _i - x)	(x _i - x) ²
1	6.3	-1.6	2.56
2	6.5	-1.4	1.96
3	6.7	-1.2	1.44
4	7.4	-0.5	0.25
5	7.6	-0.3	0.09
6	8.1	0.2	0.04
7	8.3	0.4	0.16
8	8.4	0.5	0.25
9	9.5	1.6	2.56
10	10.2	2.3	5.29

Variance = $\frac{\sum (x_i - x)^2}{n - 1}$

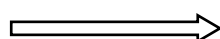
Variance = $\frac{14.6}{(10 - 1)}$



Variance = 1.62

Coefficient of variation (CV%):-

SD = 1.62



SD = 1.27

It is the standard deviation expressed in percentage out of the mean.

$$CV\% = \frac{SD}{Mean} \times 100$$

It is used in statistics in the following states;

- 1- To compare the variability of two groups for the same variable but measured by different units. So we cannot compare the variability of the two groups by SD but we can compare it by (CV%).

Example:-

Birth weight = 3.5 ± 0.5 Kg ⇨ In Iraq

Birth weight = 7.0 ± 1.5 Ib ⇨ In England

$$CV\% = \frac{SD}{Mean} \times 100$$

$$CV\% = \frac{0.5}{3.5} \times 100 \quad \Rightarrow \quad \% CV = 14.28 \% \text{ in Iraq}$$

$$CV\% = \frac{1.5}{7.0} \times 100 \quad \Rightarrow \quad \% CV = 21.4 \% \text{ In England}$$

- 2- To compare the variability of two groups for the same variable measured by the same units and they have the same SD value but different means.

Example:-

Birth weight = 3.5 ± 0.5 Kg health born infants

Birth weight = 2.5 ± 0.5 kg congenital abnormal infants

$$CV\% = \frac{SD}{Mean} \times 100$$

%CV in healthy infants = 14.28 %

% CV in abnormal infants = 20 %

Example : systolic blood pressure of 8 patients was found be as follows 120 , 111 , 124 ,142, 131 , 153 , 120 , 123 . calculate sd ? median ? mode ?

Example : consider the following set of replicate measurement : 3.5 , 3.1 , 3.1 , 3.3 ,2.5 calculate central tendency and dispersion ?

Home Work:-

Q : 13 patients who were treated with highly active therapy for at least 6 months. The immune tests for the 13 subjects are : 230 205 313 207 227 245 173 58 103 181 105 301 169 . For each of the data calculated (1) mean (2) median, (3) mode (4) range (5) variance (6) coefficient of variation.

Q\ Calculate Mean, Mode, Median, Range, Variance and standard deviation of the following set of data.

Case	1	2	3	4	5	6	7	8	9	10
T.G	190	185	192	195	190	220	187	182	220	190

😊 High precision measurements have _____ standard deviation ,variance

