- Other measures of absolute dispersion :

There are some other measuring absolute dispersion but few were used and then called semi-ranges such as are :

A. Semi-interquartile range and is symbolized by the (Q) . $Q = (Q3 - Q1) / 2$.

Q1 is the first interquartile and Q3 is the third interquartile .

B**. The semi range or Almtini : The semi range (10:90) = $(P_{90} - P_{10})/2$.**

- The relative dispersion measures: its significance when comparing the two groups and is differ in one or more of measurement units for the values, because relative dispersion measures are not having units of measurement and the most important of relative dispersion measures are :

(1).Coefficient of variation and is symbolize C.V. **C.V.= $(S/\bar{y}) \times 100$** .

Example 1.Results of final exams in the statistics and chemistry of the first class was as follows:

Data	statistic	chemistry
Arithmetic Mean:	78	73
Standard deviation:	08	76

Find the grades dispersion at any subjects was more :

solution :

C.V.= $(S/\bar{y}) \times 100$

C.V. = $(8/78) \times 100 = 10.25\%$. for statistic science .

C.V. = $(76/73) \times 100 = 104.10\%$. for chemistry science .

Dispersion degrees was more at chemistry as compared to the statistic .

Example 2. The experiment was conducted to study the length of plant (cm) and amount of yield crop (kg) for 150 plants of maize . The results were as follows:

Data	length	yield
Arithmetic Mean:	200	800
Standard deviation:	16	36

Compare dispersion between two traits :

solution :

C.V.= $(S/\bar{y}) \times 100$

C.V. = $(16/200) \times 100 = 8.00\%$. for length .

C.V. = $(36/800) \times 100 = 4.5\%$. for yield crop .

There are other of relative dispersion measures, namely :

1.Standard coefficient of variation (in the case we can use the standard deviation) :

C.V.= $(S/\bar{y}) \times 100$.

2. Interquartile coefficient of variation (in the case we can use the interquartile range) .

C.V.= $(Q_3 - Q_1) / (Q_3 + Q_1)$.

3.The coefficient of variation mean (in the case we can use the deviation mean): **C.V.= $(M.D/\bar{y}) \times 100$** or **C.V.= $(MD/Me) \times 100$** .

- Standard scores :

In many cases, we need to compare two items from two different groups. In this case, it must be converted the observations into standard units so that the comparison is meaningful using the arithmetic mean and standard deviation for each group.The standard scores have no units were used in the measurement. As we convert all the values to standard scores, the arithmetic mean of these standard scores is zero and the variance is equal to one. The Z is naturally distributed by arithmetic mean is equal to zero and a standard deviation is to one

The Z_i value is called a standard score . $Zi = (Yi-\bar{Y}) / S$.

$Z = (y_i - \bar{y}) / S$

Z standard class .

y_i variable to calculate the standard degree for him .

$\bar{y}$ the arithmetic mean .

S standard deviation .

If we convert all values to standard deviation, the arithmetic mean of these standard grades equal to zero and that the variance is equal to 1. This means that Z_i is distributed naturally for equal is to zero mean and is variance equal to 1.

Example 1. The was student got a score 84 in the final exam in mathematics and that the arithmetic mean in mathmatic for all students exam was 76 and the standard deviation of 10. The same physics exam the student has earned a grade of 90, where he was the arithmetic mean in physics exam for all students equal to 82 standard deviation equal to 16 in the Bible, What any two subjects were higher susceptibility student .

solution :

$Z = (y_i - \bar{y}) / S$

Z = $(84 - 76) /10 = 8/10 = 0.8$. for arithmetic .

Z = $(90 - 82) /16 = 8/16 = 0.5$. for physics .

Thus the students ability to pass the mathematics exam is higher than in physics .

Example 2. Convert the following values to standard scores : yi = 6, 2, 8, 7, 5 .

$\bar{Y} = \sum Yi/n$

$\bar{Y} = 6 + 2 + 8 + 7 + 5 /5 =$

$\bar{Y} = 28/5 = 5.6$.

$$S = \sqrt{[\sum \mathbf{yi^2} - (\sum yi)^2 /n] /n - 1} .$$

$$S = \sqrt{[(6^2 + 2^2 + 8^2 + 7^2 + 5^2) - (28)^2 /5] /5 - 1} =$$

$$S = \sqrt{[(36 + 4 + 64 + 49 + 25) - (784)/5] /4} =$$

$$S = \sqrt{[178 - 156.8] /4} =$$

$$S = \sqrt{[\ 21.2\ ] /4} =$$

$$S = \sqrt{5.3} =$$

S = 2.30 .

$Z = (Y_i - \bar{Y}) / S$

$Z_1 = (6 - 5.6) / 2.30 = 0.4/ 2.30 = 0.174$.

$Z_2 = (2 - 5.6) / 2.30 = - 3.6/ 2.30 = - 1.565$.

$Z_3 = (8 - 5.6) / 2.30 = 2.4/ 2.30 = 1.043$.

$Z_4 = (7 - 5.6) / 2.30 = 1.4/ 2.30 = 0.609$.

$Z_5 = (5 - 5.6) / 2.30 =- 0.6/ 2.30 =- 0.261$.

Classes (Z scores)	fi	Percentage (%)
High scores : 1.043	1	20%
Medium scores : 0.609 , 0.174	2	40%
Low scores : -1.565 , -0.261.	2	40%
Sum	5	100%

-The variance: It is one of the dispersion and more widely used in practical respects and it reflects the average of deviations squares than it arithmetic mean .

First: The variation of society :If there were available readings for each observations of community and let X_1, X_2, X_3, X_4, X_5 .... X_n , the variance of society was symbolizes (σ^2) and it is calculated by the following equation:

$$\sigma^2 = \sum(X - \mu)^2 / n \ .$$

Example 1. The manufacturer of food packaging the number of 15 of employs were working and had many years of experience of these workers are as follows:

X_i = 5, 13, 7, 14, 12, 9, 6, 8, 10, 13, 14, 6, 11, 12, 10 .

Find the variance number of experience years ?

Solution :

Years of experience (X)	(X- μ)	$(X- \mu)^2$
5	5 - 10 = -5	25
13	13 - 10 = 3	9
7	7 - 10 = -3	9
14	14 - 10 = 4	16
12	12 - 10 = 2	4
9	9 - 10 = -1	1
6	6 - 10 = -4	16
8	8 - 10 = -2	4
10	10 - 10 = 0	0
13	13 - 10 = 3	9
14	14 - 10 = 4	16
6	6 - 10 = -4	16
11	11 - 10 = 1	1
12	12 - 10 = 2	4
10	10 - 10 = 0	0
Total = 150	0	130

$\mu = \sum X_i / n$

μ = (5 + 13 + 7 + 14 + 12 + 9 + 6 + 8 + 10 + 13 + 14 + 6 + 11 + 12 + 10)/15 =

μ = 150/15 =

μ = 10 .

$$\sigma^2 = \sum(X - \mu)^2 / n \ .$$

$$\sigma^2 = (130) / 15 = 8.66 \ .$$

Second: Sample variation (S^2) : if there were the community variation (σ^2) was unknown at sometime ,in this case it was used sample variation .The sample was withdrawn from society and it calculates from the sample data to estimate variance society. If there were available readings of sample size (n) which was X_1, X_2, X_3, X_4, X_5 .... X_n the sample variance was symbolizes by symbol (S^2) and it is calculated by the following equation :

$S^2 = \sum(X - \bar{X})^2 / n\text{-}1$.

Example 2. A sample size of five workers were withdrawn from the workforces at the factory and they had number of years of experience for them as follows:

$X_i = 8, 13, 10, 5, 9$.

Calculate the variance years of experience in the sample?

Solution :

Years of experience (X)	$(X - \bar{X})$	$(X - \bar{X})^2$
8	8 - 9 = -1	1
13	13 - 9 = 4	16
10	10 - 9 = 1	1
5	5 - 9 = -4	16
9	9 - 9 = 0	0
Total = 45	0	34

$\bar{X} = \sum X_i / n$

$\bar{X} = (8 + 13 + 10 + 5 + 9)/5 = 45/5 = 9$.

$\bar{X} = 45/5 = 9$.

$\bar{X} = 9$.

$S^2 = \sum(X - \ddot{X})^2 / n\text{-}1$.

$S^2 = (34) / 5 - 1 = 34/4 = 8.50$.

$S^2 = 34 / 4 =$

$S^2 = 8.50$.