Unit-III Measures of Dispersions and Scales Meaning, Purpose, Calculation and advances of Range, Quartile, Deviation, Mean Deviation, Standard Deviation, Probable Error. Meaning, Purpose, Calculation and advantages of scoring scales; Sigma scale, Z Scale, Hull scale and T-scale.

Range:

The range is the simplest measure of dispersion. It is a rough measure of dispersion. Its measure depends upon the extreme items and not on all the items.

Range = Largest value – Smallest value (R= L – S) Coefficient of range = (L-S) / (L+S)

Quartile Deviation:

By eliminating the lowest 25% and the highest 25% of items in a series, the central 50% values which are ordinarily free of extreme values is known as quartile deviation. To obtain quartile deviation half of the distance between the first and the third quartiles is calculated, which is also known as 'Semi Inter Quartile Range'.

Quartile deviation (QD) = (Q3-Q1)/2

Coefficient of quartile deviation = (Q3-Q1) / (Q3+Q1)

For symmetrical distribution series, Q3= QD+Median Q1=Median – QD

RANGE

Merits:

1. It is simple to compute and understand.
2. It gives a rough but quicker answer.

Demerits:

1. It is not reliable, because it is affected by the extreme items.
2. Usually, frequency distribution may be concentrated in the middle of the series. But the range depends on extreme items, it is an unsatisfactory measure.
3. It cannot be applied to open end cases.
4. It is not suitable for mathematical treatment.

Quartile Deviation

Merits:

1. It is simple to understand and easy to compute.

2. It is not influenced by the extreme values.

3. It can be found out with open end distribution.

4. It is not affected by the presence of extreme items.

Demerits:

1. It ignores the first 25% of the items and the last 25% of the items.

2. It is positional average, hence not amenable to further mathematical treatment.

3. Its value is affected by sampling fluctuations.

4. It gives only a rough measure.

Mean Deviation:

Mean deviation is the average amount of scatter of the items in a distribution from either the mean or the median, ignoring the signs of the deviation. – **Clark and Schekade.**

Mean deviation = $\Sigma D / N$

Coefficient of mean deviation = Mean deviation / mean or median or mode

Standard Deviation:

Karl Pearson introduced the concept of standard deviation in 1893.

Standard deviation is defined as positive square-root of the arithmetic mean of the squares of the deviations of the given observation from their arithmetic mean. The standard deviation is denoted by σ (Sigma). Standard deviation indicates the spread of the middle 68.26 percent of scores taken from the mean.

Mean Deviation

Merits:

1. It is simple to understand and easy to compute. Mean deviation is a calculated value.

2. It is not much affected by the fluctuations of sampling.

3. It is based on all items of the series and gives weight according to their size.

4. It is less affected by the extreme items.

5. It is rigidly defined.

6. It is flexible because it can be calculated from any measure of central tendency.

7. It is better measure for comparison.

Demerits:

1. It is non-algebraic treatment.

2. Algebraic positive and negative signs are ignored.

3. It is not a very accurate measure of dispersion.

4. It is not suitable for further mathematical calculation.

5. It is rarely used.

Standard Deviation

Merits:

1. It is rigidly defined, and its value is always definite and based on all the observations and the actual signs of deviations are used.

2. As it is based on arithmetic mean, it has all the merits of arithmetic mean.

3. It is the most important and widely used measure of dispersion.

4. It is possible for further algebraic treatment.

5. It is less affected by the fluctuations of sampling, and hence stable.

Demerits:

1. It is not easy to understand, and it is difficult to calculate.

2. It gives more weight to extreme values because the values are squared up.

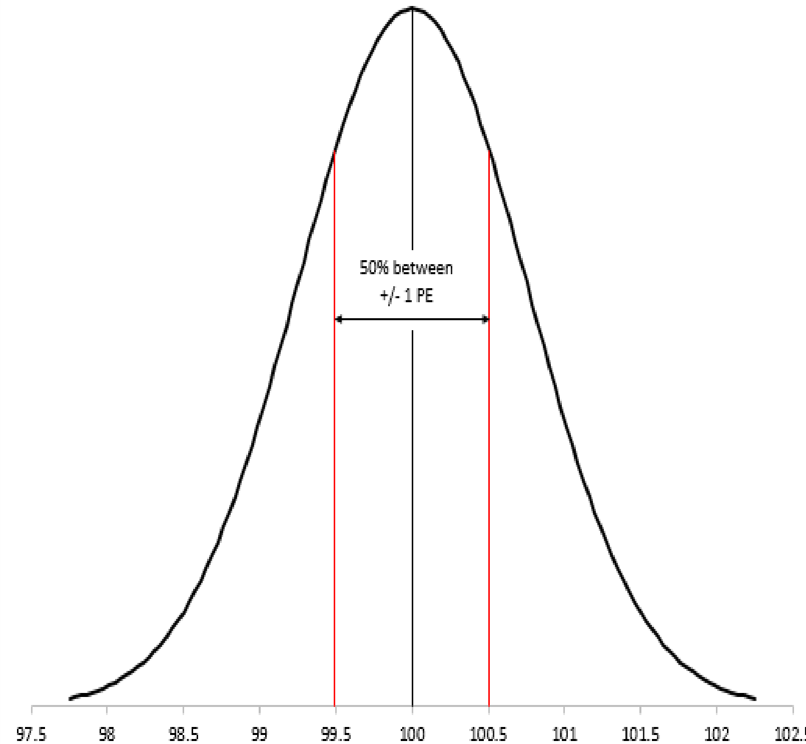
3. It is affected by the value of every item in the series.

4. As it is an absolute measure of variability, it cannot be used for the purpose of comparison.

Probable error:

In statistics, probable error defines the half-range of an interval about a central point for the distribution, such that half of the values from the distribution will lie within the interval and half outside. Probable error is a quantity formerly used as a measure of variability: equal to 0.6745 times the standard deviation. A normally distributed population has half of its elements within one probable error of the mean.

Probable error, PE = 0.6744898σ



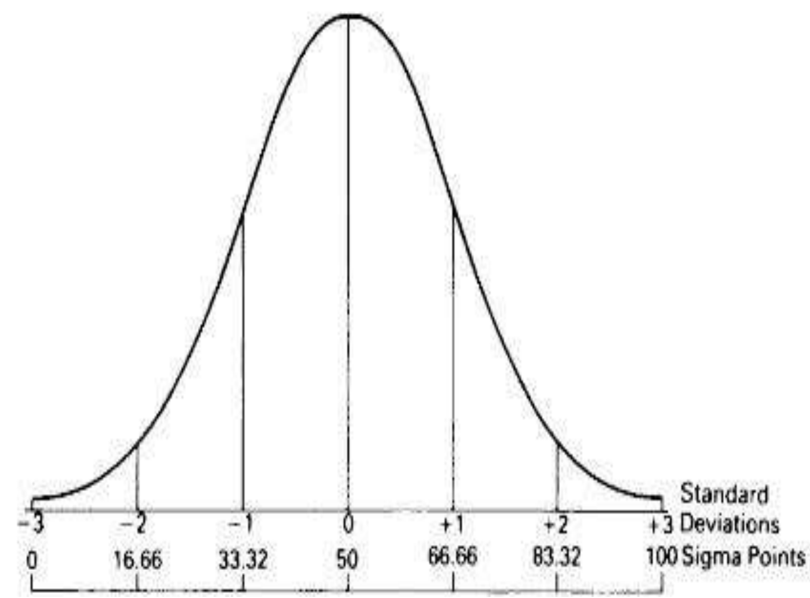
Sigma scale:

In the construction of a sigma scale the distribution curve is divided into 100 equal parts along its horizontal axis, commencing with the 0 at 3 standard deviations below the mean and finishing with the 100 at 3 standard deviations above the mean. Figure showing Sigma points and standard deviation

$$Z = \frac{X - M}{S.D.}$$

X = Raw score M = Mean

S.D = Standard Deviation



Z SCALE:

The standard score of a raw score x[1] is.

$Z=(X- \mu)/ \sigma$

μ is the mean of the population.

σ is the standard deviation of the population.

Hull scale:

The Hull scale (named after its originator) is another way of transforming Z scores into a simpler measure of relative position defined in points from 0 to 100.

In the Hull scale again divide the distribution curve into 100 equal parts, but this time the starting point (0) is positioned 3.5 standard deviations below the mean and the finishing point. (100) 3.5 standard deviations above the mean.

Hull points = $14.28Z+50$

T-scale:

Another method of scaling which divides the distribution curve into 100 equal parts obtains an even greater spread of raw scores than in the Hull scale. The starting point (0) is placed 5 standard deviations below the mean and the finishing point (100), 5 standard deviations above the mean.

T-scale points = $10Z+50$