SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution
Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

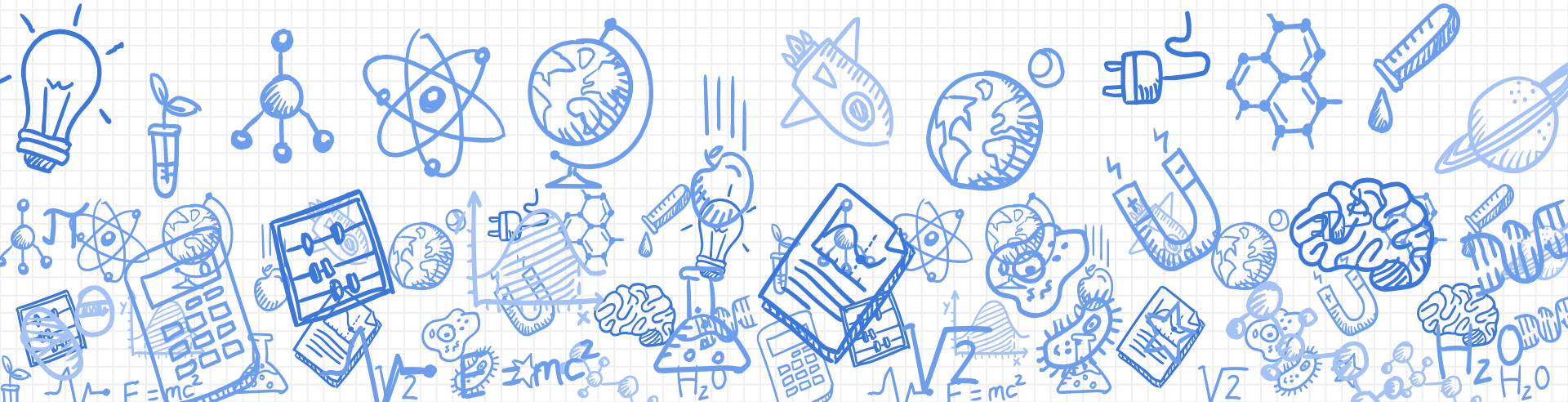
DEPARTMENT OF MECHANICAL ENGINEERING

16MEE304 – TOTAL QUALITY MANAGEMENT

IIIYEAR - V SEM

UNIT 3 – STATISTICAL PROCESS CONTROL

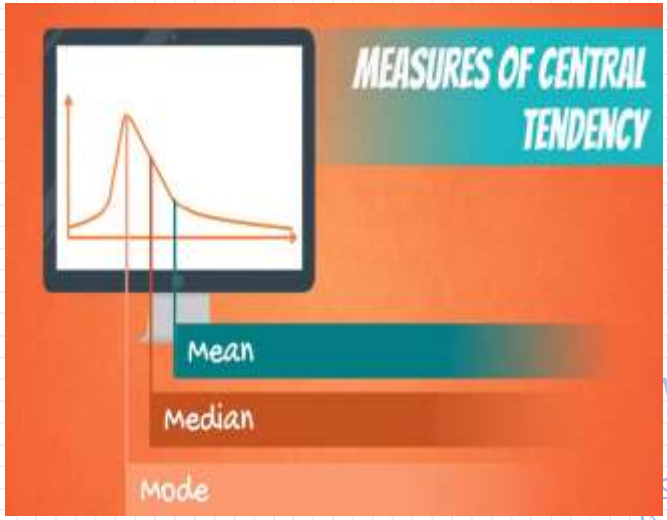
TOPIC – Statistical Fundamentals



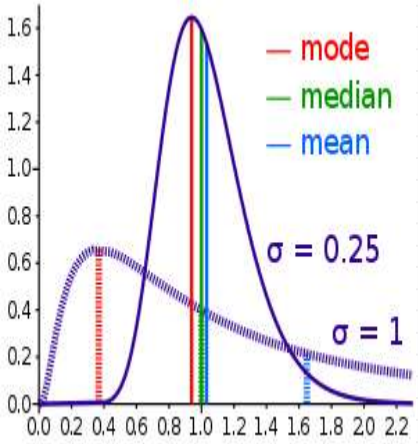
Measures of central tendency and dispersion

Two important types of statistics are **measures of central tendency and measures of dispersion.**

A measure of central tendency is a number used to represent the center or middle of a set of data values. The mean, median, and mode are three commonly used measures of central tendency.



Measures of central tendency



Mean, median and mode

These are all measures of central tendency. They help summarize a bunch of scores with a single number.

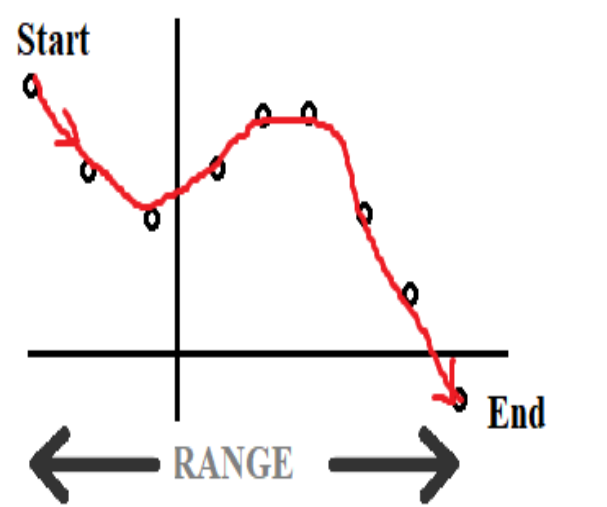
Suppose you want to describe a bunch of data that you collected to a friend for a particular variable like height of students in your class.

Measures of dispersion

Range, variance and standard deviation

These are all measures of dispersion.

These help you to know the spread of scores within a bunch of scores.



Mean, median and mode

Mean, median, and mode are different measures of center in a numerical data set. They each try to summarize a dataset with a single number to represent a "typical" data point from the dataset.

Mean: The "average" number; found by adding all data points and dividing by the number of data points.

Example: The mean of 4, 1, and 7 is (4+1+7)/3 = 12/3 =**4**.

Mean, median and mode

Median: The middle number; found by ordering all data points and picking out the one in the middle (or if there are two middle numbers, taking the mean of those two numbers).

Example: The median of 4, 1, and 7 is 4 because when the numbers are put in order 1, 4, 7),
The Median is **4** is in the middle.

Mean, median and mode

Mode: The most frequent number—that is, the number that occurs the highest number of times.

Example: The mode of 4, 2, 4, 3, 2, 2},
Mode is **2**
Because it occurs three times, which is more than any other number.

Range, variance and standard deviation

Range = the difference between the highest and lowest numbers

Variance = how spread out (far away) a number is from the mean

Standard Deviation = loosely defined as the average amount a number differs from the mean

Range, variance and standard deviation

Range:

R = maximum score - minimum score

In order to figure out the range, **A)** arrange your data set in order from lowest to highest and **B)** subtract the lowest number from the highest number.

A) When arranged in order, 4, 6, 3, 7, 9, 4, 2, 1, 4, 2 becomes: 1, 2, 2, 3, 4, 4, 4, 6, 7, 9

B) The lowest number is 1 and the highest number is 9. Therefore, R = 9-1 = 8

Range, variance and standard deviation

Variance:

Variance and standard deviation are closely related. There are 2 different formulas used to compute the variance: the computational formula and the conceptual formula. We will explain both.

$$S^2 = \frac{\Sigma(X^2) - \frac{(\Sigma X)^2}{N}}{N}$$

From the above formula:

S^2 = variance

Σ = sigma = the sum of (add up all the numbers)

X = the numbers from your data set

X^2 = the numbers from your data set squared

N = the total number of numbers you have in your data set

Range, variance and standard deviation

Standard deviation

Standard deviation is simply the square root of the variance. Therefore, it does not matter if you use the computational formula or the conceptual formula to compute variance.

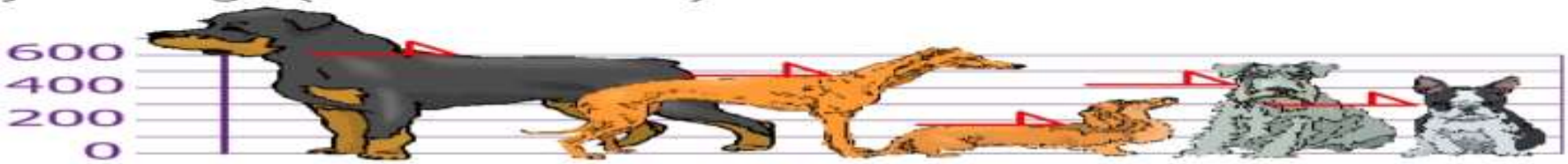
For our sample data set, our variance came out to be 5.56, regardless of the formula used. The standard deviation for our data set then becomes:

S = Root of 2.36

Multiple Choice Questions

Example

You and your friends have just measured the heights of your dogs (in millimetres):



The heights (at the shoulders) are: 600mm, 470mm, 170mm, 430mm and 300mm.

Find out the Mean, the Variance, and the Standard Deviation.

Your first step is to find the Mean:

Answer:

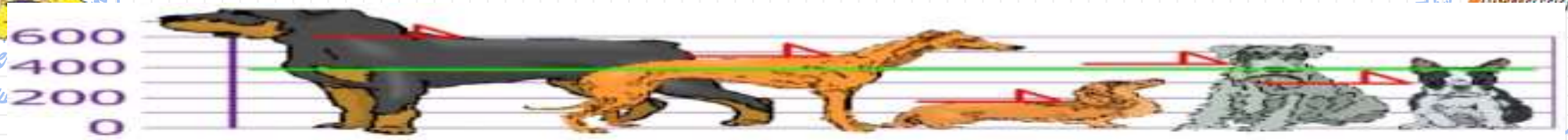
$$\text{Mean} = \frac{600 + 470 + 170 + 430 + 300}{5}$$

$$= \frac{1970}{5}$$

$$= 394$$

so the mean (average) height is 394 mm. Let's plot this on the chart:

Multiple Choice Questions



Now we calculate each dog's difference from the Mean:

To calculate the Variance, take each difference, square it, and then average the result:

Variance

$$\sigma^2 = \frac{206^2 + 76^2 + (-224)^2 + 36^2 + (-94)^2}{5}$$

$$= \frac{42436 + 5776 + 50176 + 1296 + 8836}{5}$$

$$= \frac{108520}{5}$$

$$= 21704$$

So the Variance is **21,704**

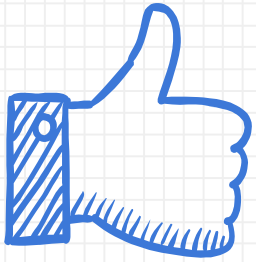
And the Standard Deviation is just the square root of Variance, so:

Standard Deviation

$$\sigma = \sqrt{21704}$$

$$= 147.32\ldots$$

$$= \mathbf{147}\ \textit{(to the nearest mm)}$$



THANKS!