

Department of CSE
(School of Technology)



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MATH2361: Probability and Statistics

(No. of hrs/week: 3 Credits: 3)

@Semester –IV

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UNIT-I

Measures of Central Tendency

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Learning Objectives

By the end of this topic, students should be able to:

- Learn Measures of Central Tendency
- Understand how to find Averages of the data
- Analyze the given data using MS-Excel/R-programming

Learning Outcomes



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Upon successful completion of this topic, students will be able to:

2

Apply measures of Central tendency

3

Solve the problems on Averages

4

Analyze the given data using MS-Excel

Contents

Measures of Central Tendency

Mean Median Mode

Geometric Mean Harmonic mean

Properties

Sample Problems on Averages

Analysis of the data using MS-Excel

Prerequisite: Data and Data Sets

- Data are the facts and figures collected, summarized, analyzed, and interpreted.
 - The data collected in a particular study are referred to as the data set.

Prerequisite: Elements, Variables, and Observations



- The elements are the entities on which data are collected.
- A variable is a characteristic of interest for the elements.
- The set of measurements collected for a particular element is called an observation.
- The total number of data values in a data set is the number of elements multiplied by the number of variables.

Central Tendency: Definition



- It is a statistical constant.
- A single quantity or effort gives the significance of whole data.
- Measure of Location.
- It is an entity or observation will give an idea about central part of the data / Distribution

Measure of Central Tendency

It can be measured by using five Measures

- Arithmetic Mean (AM)(simply Mean (M))
 - Median (Md)
 - Mode (Mo)

 - Geometric Mean (GM)
 - Harmonic Mean (HM)
- Note :**
1. Median & Mode : Positional Averages
 2. Empirical relationship between averages
Mode = 3 median - 2 mean (Asymmetric Distribution)
Mean = Median + Mode (Symmetric Distribution)
 3. $AM \times HM = GM^2$

Measures of Central Tendency

Generally, the central tendency of a dataset can be described using the following measures:

- **Mean (Average):** Represents the sum of all values in a dataset divided by the total number of the values.
- **Median:** The middle value in a dataset is arranged in ascending order (from the smallest value to the largest value). If a dataset contains an even number of values, the median of the dataset is the mean of the two middle values.
- **Mode:** Defines the most frequently occurring value in a dataset. In some cases, a dataset may contain multiple modes while some datasets may not have any mode at all. It should be easy to understand and compute.

Note: In case of grouped and continuous frequency distribution the definitions and formula are there.



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Measures of Central Tendency

- The geometric mean (G.M.) and the harmonic mean (H.M.) form an important measure of the central tendency of data.
- They tell us about the central value of the data about which all the set of values of data lies.
- Suppose we have a huge data set and we want to know about the central tendency of this data set.
- We have so many ways by which we can do so. But what if the data sets fluctuate or we need to add or remove some of the data value? Calculating the average value or the central value will be a tiresome and troublesome task. So, we use geometric and harmonic means as our rescuer.



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Measures of Central Tendency

Geometric Mean

- A geometric mean is a mean or average which shows the central tendency of a set of numbers by using the product of their values. For a set of n observations, a geometric mean is the n th root of their product.

Harmonic Mean

- A simple way to define a harmonic mean is to call it the reciprocal of the arithmetic mean of the reciprocals of the observations. The most important criteria for it is that none of the observations should be zero.

Properties of an ideal (good) Measure



It should be rigidly defined.



It should be easy to understand and compute.



It should be based on all items in the data.



Its definition shall be in the form of a mathematical formula.



It should be capable of further algebraic treatment.



It should have sampling stability.



It should be capable of being used in further statistical computations or processing.



Note: Of all five measures of Averages the Arithmetic mean(AM) is an ideal measure it obeys all the above properties of an ideal measures.

Measures of Central Tendency

- The selection of a central tendency measure depends on the properties of a dataset.

For instance, the mode is the only central tendency measure for categorical data, while a median works best with ordinal data.

- Although the mean is regarded as the best measure of central tendency for quantitative data, that is not always the case.

For example, the mean may not work well with quantitative datasets that contain extremely large or extremely small values. The extreme values may distort the mean. Thus, you may consider other measures.

- The measures of central tendency can be found using a formula or definition. Also, they can be identified using a frequency distribution graph.

Problems for Practice



1.(a) Find the arithmetic mean of the following frequency distribution:

x: 1 2 3 4 5 6 7

f: 5 9 12 17 14 10 6

(b) Calculate the arithmetic mean of the marks. From the following table:

Marks :	0-10	10-20	20-30	30-40	40-50	50-60
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No. of students:	12	18	27	20	17	6
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2. Calculate the mean for the following frequency distribution.

Class-interval: 0-8 8-16 16-24 24-32 32-40 40-48

Frequency	8	7	16	24	15	7
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3. The average salary of male employees in a firm was Rs.520 and that of females was Rs.420. The mean salary of the total employees was Rs.500. Find the percentage of male, and female employees.

4. Find the simple and weighted arithmetic mean of the first n natural numbers, the weights being the corresponding numbers.

Problems for Practice



5. Find the median wage of the following distribution:

Wages (in Rs.) : 20-30 30-40 40-50 50--60 60-70

No. of labourers. : 3 5 20 10 5

6. An incomplete/requency distribution is given as/ollows'

Variable	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total Frequency
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Frequency	12	30	?	65	?	25	18	229
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Given that the median $v\{flue$ is 46, determine the missing frequencies using the median formula.

6. Find the mode/or the following distribution:

Class - interval: 0-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80

Frequency 5 8 7 12 28 20 10

7. The Median and Mode of the following wage distribution are known to be Rs. 33.50 and Rs. 34 respectively. Find the values of f_3 , f_4 and f_5 .

Wages: (in Rs.)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	total
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Frequency:	4	16	f_3	f_4	f_5	6	4	230
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Problems for Practice



8. Given below is the distribution of 140 candidates obtaining marks X or higher in certain examinations (all marks are given in whole numbers) :

X : 10 20 30 40 50 60 70 80 90 100

c.f. : 140 133 118 100 75 45 15 9 2 0

Calculate the mean, median and mode of the distribution.

9. (a) The mean of marks obtained in an examination by 100 students was 49.96. The mean of the marks obtained in the same examination by another group of 200 students was 52.32. Find the mean of the marks obtained by both groups of students taken together.

(b) A distribution consists of three components with frequencies 300, 200 and 600, which are 16, 8 and 4, respectively. Find the mean of the combined distribution.

(c) The mean marks of 300 students in the subject of Statistics are 45. The mean of the top 100 of them was found to be 70, and the mean of the last 100 was known to be 20. What is the mean of the remaining 100 students?

(d) The mean weight of 150 students in a certain class is 60 kilograms. The mean weight of boys in the class is 70 kilograms and that of the girls is 55 kilograms. Find the number of boys and number of girls in the class. Ans. (a) 51.53, (b) 8, (c) 45, (d) Boys = 50, Girls = 100.

Any Questions? Suggestions?

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Thank you

Feedback to
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