214en18

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ANALYSIS OF DATA

Economic data are usually studied with the help of statistical methods. Science of statistics is a method of collection, classification and tabulation of numerical facts, which help in explanation, description and comparison of phenomena.

Clearly in singular sense statistics is a scientific subject, which is descriptive as well as conclusive. In descriptive statistics we include a complete gamut of scientific enquiry. In all kinds of statistical enquiry the first step is to gather the facts through various methods. The facts collected from respondents are first edited. These facts are then presented with the help of tables, graphs and diagrams. Quantitative information is statistically analysed. Representative figures are interpreted in the context they have been studied.

OBJECTIVES

After completing this lesson, you will be able to:

- *understand the meaning of the term central tendency;*
- *use the concept of average in your day-to-day life;*
- *calculate arithmetic mean of various series;*
- *use alternate methods to calculate arithmetic mean.*

18.1 MEANING OF CENTRAL TENDENCY

After the data have been collected, organised and presented they need to be analysed. Analysis of data is a technique through which significant fact from the numerical data are extracted. One of the most important objects of statistical analysis is to get one single value that describe the characteristics of the whole data.

In statistics we deal with certain problems, which are largely affected by multiplicity of causes. Whatever conclusions we draw are based on combined effect of the various

causes and it is very difficult to trace out impact of all such causes separately. However, the first step in data analysis is to ascertain representative values from the raw data. It is known as average or measure of central tendency.

Raw data are first edited and then converted into frequency distribution. One of the basic purposes of descriptive statistics is to find out a most representative value or figure from the data. This representative figure is called average or mean. This is the value or single figure, which is typical to all. This is also known as measure of central tendency. Thus averages are the descriptive statistics, which measure the tendency called central tendency. It has been well established that there is a tendency of data to move towards a particular direction.

Tendency of data to cluster towards the central location or value is called central tendency.

The purpose for computing an average value for a set of data is to obtain a single value which is representative of all the items and which the mind can grasp simply and quickly. The single value is the point around which the individual items cluster.

We often use the term average in our day-to-day discussions. If one claims that his average marks are 76 out of 100 in 6 subjects. It shows that he succeed in total of 456 i.e. 76×06 marks. For example, if actual runs scored by Sachin in five innings in a series are 59, 78, 100, 50 and 63 he scored 350 runs in total. His average score is 350/5 = 70. It is important to note that Sachin never scored exactly 70 runs in any inning he played. However, on an average this figure is a good representative of his scores in five innings.

The purpose of computing an average value for a set of observations is to obtain a single value which is representative of all the items and which the mind can grasp simply and quickly.

18.2 PURPOSE AND FUNCTIONS OF AVERAGES

- to convert the collected information and raw data in brief
- to facilitate comparison between two or more groups
- to present a representative value from raw data
- to facilitate future policy and programme.

18.3 ARITHMETIC MEAN AS A MEASURE OF CENTRAL TENDENCY

There are various measures of central tendency. Arithmetic mean is one of them

Arithmetic mean is obtained by dividing the sum of the items by the number of items mathematically speaking:

$$\bar{X} = \frac{\Sigma x}{N}$$

where, x = item

Σx = sum of the item

N = Number of items and

$\bar{X}$ = Arithmetic mean

Arithmetic mean in common language is popularly known as average. It is very easy to calculate it, say for example there are 10 students in a class. They scored marks in economics out of 10 as follows

Student	A	B	C	D	E	F	G	H	I	J
Mark	2	7	10	8	6	3	5	4	5	0

Here 'x' is marks in economics. Let us start with the sum of the 2 + 7 + 10 + 8 + 6 + 3 + 5 + 4 + 5 + 0 = 50, clearly 10 students secured 50 marks (Σx) in all. Number of students (N) is 10, the average of the marks scored by 10 students is thus 50/10 = 5 in other words

$$\bar{x} = \frac{\Sigma x}{N} = \frac{50}{10} = 5$$

INTEXT QUESTIONS 18.1

1. Give an example of central tendency.
2. Give basic formula to calculate arithmetic mean.
3. if sum of items is 40 and mean is 4 find out "N" (number) of items.
4. Weekly consumption of sugar of Mr. Raja is 35 kg what is his average daily consumption?
5. If average marks of 10 students is 50 if one more student is added to group who secured 5 marks. What will be the new average?

18.4 CALCULATION OF ARITHMETIC MEAN IN DIFFERENT TYPES OF SERIES

As given in Lesson 17, data can be organized in different types of series. They are – Individual series, Discrete series and Continuous series. Calculation of arithmatic mean for different series of data is given below

A. Individual series: Above formula for calculation of arithmetic mean or mean is valid under all circumstances. However, if shortcut method is to be used for complexed data, above formula is modified as follows:

$$\bar{x} = A + \frac{\Sigma dx}{N}$$

Here A is assumed mean, dx is deviating x from assumed mean and N is number of items.

Illustration 1. Ascertain arithmetic mean from the following marks secured by 10 students out of 30.

x : 4, 3, 8, 9, 12, 10, 25, 10, 21 and 20

x = Marks

Solution

(a) Direct method

$$\Sigma x: 4 + 3 + 8 + 9 + 12 + 10 + 25 + 10 + 21 + 20 = 122$$

$$\bar{x} = \frac{\Sigma x}{N} = \frac{122}{10} = 12.2$$

(b) Shortcut method

x marks	dx = x–A A = 12 = x –12
4	–8
3	–9
8	–4
9	–3
12	0
10	–2
25	+13
10	–2
21	+9
20	+9
Σx = 122	Σdx = 2

Let us assume 12 as assumed mean (A)

$$\bar{x} = A + \frac{\Sigma dx}{N} = 12 + \frac{2}{10}$$

$$\bar{x} = 12 + 0.2 = 12.2$$

B. Discrete series: for ascertainment of arithmetic mean in discrete series following formulae can be used

(a) Direct method

$$\bar{x} = \frac{\Sigma fdx}{N}$$

where N = Sum of frequencies

(b) Shortcut method

$$\bar{x} = A + \frac{\Sigma fdx}{N}$$

Illustration 2. Calculate arithmetic mean from the data given below:

Number of children per family	0	1	2	3	4	5	6
Number of families	13	17	20	40	20	17	13

Solution.

(a) Direct method

x = number of children

f = number of families

x	f	fx
0	13	0
1	17	17
2	20	40
3	40	120
4	20	80
5	17	85
6	13	78
	140	420

$$\bar{x} = \frac{\Sigma fx}{N} = \frac{420}{140} = 3$$

Thus, average is 3, which indicates that there are 3 children per family on an average

(b) Shortcut method

x	f	dx = (x – A) A = 2	fdx
0	13	–2	–26
1	17	–1	–17
2	20	0	0
3	40	+1	40
4	20	+2	40
5	17	+3	51
6	13	+4	52
	140		+183
			–43
			140

$$\bar{x} = A + \frac{\Sigma fdx}{N} = 2 + \frac{140}{140} = 3$$

C. Continuous series: Following three methods are used for ascertainment of arithmetic mean in a continuous series

(a) Direct method

$$\bar{x} = \frac{\Sigma fdx}{N}$$

(b) Shortcut method without step deviation

x = mid value of a class

$$\bar{x} = A + \frac{\Sigma fdx}{N}$$

(c) Shortcut method with step deviation

$$\bar{x} = A + \frac{\Sigma fdx'}{N} \times c$$

Here c = common factor

Calculation of arithmetic mean for continuous series is explained in detail below with the help of an example

Illustration 3. The marks secured by 300 students in a school

x (marks)	0-10	10-20	20-30	30-40	40-50	50-60	60-70
f(no. of students)	23	27	40	120	40	27	23

Solution. First let us calculate mid value for each class. It is done by taking a sum of lower and upper limit of each group and dividing it by 2 i.e.

$$x = \frac{L_1 + L_2}{2}, \frac{0+10}{2}, \frac{10+20}{2}, \frac{20+30}{2}, \frac{30+40}{2}, \frac{40+50}{2}$$

$$\frac{50+60}{2}, \frac{60+70}{2} \text{ i.e. } 5, 15, 25, 35, 45, 55 \text{ and } 65$$

Here L_1 is lower limit while L_2 is the upper limit of each class

(a) Direct method

x	$x = \frac{l_1 + l_2}{2}$	f	fx
0-10	5	23	115
10-20	15	27	405
20-30	25	40	1000
30-40	35	120	4200
40-50	45	40	1800
50-60	55	27	1485
60-70	65	23	1495
		300	10500

$$\bar{x} = \frac{\Sigma fx}{N} = \frac{10500}{300} = 35$$

(b) Shortcut method

(i) Without step deviation

x	f	MV(x)	dx(x–A) A – 25	fdx
0-10	23	5	–20	–460
10-20	27	15	–10	–270
20-30	40	25	0	0
30-40	120	35	+10	1200
40-50	40	45	+20	800
50-60	27	55	+30	810
60-70	23	65	+40	920
	300			3000

$$\bar{x} = A + \frac{\Sigma fdx}{N} = 25 + \frac{3000}{300} = 25 + 10 = 35$$

(c) Shortcut method with step deviation

x	Mv(x)	f	dx(x–A)A=25	$35dx^{1}_{L=1} = \left(\frac{dx}{10}\right)$	fdx^{1}
0-10	5	23	–20	–2	–46
10-20	15	27	–10	–1	–27
20-30	25	40	0	0	0
30-40	35	120	+10	1	120
40-50	45	40	+20	+2	+80
50-60	55	27	+30	3	81
60-70	65	23	+40	4	92
		300			300

$$\bar{x} = A + \frac{\Sigma fdx'}{N} \times c = 25 + \frac{300}{300} \times 10 = 35$$

18.6 PRECAUTIONS OF USING ARITHMETIC MEAN

Let us provide two important precautions while using arithmetic mean.

1. It is important to note that arithmetic mean is a theoretical value, which may not be represented by actual fact. Say for example, if in all there are 27 children in 10 families. Average number of children per family would be 2.7 (27 ÷10). It is unrealistic. There can be either 2 or 3 children per family but not 2.7.

2. Arithmetic mean cannot be qualitative data such as honesty, bravery, loyalty and beauty etc.

INTEXT QUESTIONS 18.2

1. Calculate arithmetic mean from the following data: 4, 6, 3, 7, 8, 2 and 5

2. Calculate arithmetic mean from the following data:

Marks (out of 5)	0	1	2	3	4	5
Number of student	3	7	8	5	3	4

3. If sum of the deviation measured from assumed mean of a group 10 is +50 and assumed mean is 20, what will be the actual mean.

WHAT YOU HAVE LEARNT

- Tendency of data to cluster towards the central location or value is called central tendency.
- An average is a value which is representative of set of data.
- Arithmetic mean is a mathematical average and which is commonly used as a measure of central tendency.
- Arithmetic mean is obtained by dividing the sum of the items by the number of items mathematically speaking:

$$\bar{X} = \frac{\Sigma x}{N}$$

where, x = item
Σx = sum of the item
N = Number of items and
$\bar{X}$ = Arithmetic mean

- Arithmatic mean can be calculated for Individual series, Discrete series and Continuous series by using differnt formulae.

TERMINAL EXERCISE

1. What do you mean by analysis of data?
2. What is meant by descriptive analysis?
3. Discuss the concept of central tendency.
4. What do you mean by arithmetic mean? How is it calculated?
5. Define arithmetic mean. What does it reflect?
6. What do you mean central tendency? How does arithmetic mean reflect it?
7. From the following data find out mean: 7, 4, 17, 19, 11, 16, 15, 14, 9 and 11.
8. If the following items are also added to above set of data, what would be the revised mean 18, 14, 14, 8, 10 and 21
9. Calculate mean from the data given below:

x	f
0	1
1	13
2	20
3	40
4	40
5	13
6	7

10. Calculate arithmetic mean from the data given below:

x	f
0-10	5
10-20	15
20-30	20
30-40	25
40-50	20
50-60	15
60-70	5

11. From the data given below find out mean

x	f
20-40	2
40-60	7
60-80	9
80-100	24
100-120	9
120-140	7
140-160	2

ANSWERS TO INTEXT QUESTIONS

Intext Questions 18.1

1. 1
2. $\bar{x} = \frac{\Sigma x}{N}$
3. 45.9
4. 7 kg
5. 5

Intext Questions 18.2

1. 5
2. 2.33
3. 18
4. 25

MODULE-7
INDIAN ECONOMY