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Statistics

Statistics is one of the parts of mathematics in which we study about the collecting, organizing, analyzing, interpreting and presenting data.

Statistics is very helpful in real life situations as it is easy to understand if we represent a data in a particular number which represents all numbers. This number is called the **measure of central tendency**. Some of the central tendencies commonly in use are -

Mean

It is the average of “n” numbers, which is calculated by dividing the sum of all the numbers by n.

The mean \bar{x} of n values $x_1, x_2, x_3, \dots, x_n$ is given by

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

Mean of Grouped Data (Without Class Interval)

If the data is organized in such a way that there is no class interval then we can calculate the mean by

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + \dots + f_nx_n}{f_1 + f_2 + \dots + f_n} = \frac{\sum_{i=1}^n f_i x_i}{\sum_{i=1}^n f_i}$$

where, $x_1, x_2, x_3, \dots, x_n$ are the observations

$f_1, f_2, f_3, \dots, f_n$ are the respective frequencies of the given observations.

Example

Grouped Population Mean		
x	f	fx
20	40	800
40	60	2400
60	30	1800
80	50	4000
100	20	2000
	200	$\sum fx = 11000$

Here, x_1, x_2, x_3, x_4, x_5 are 20, 40, 60, 80, 100 respectively and f_1, f_2, f_3, f_4, f_5 are 40, 60, 30, 50, 20 respectively.

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + \dots + f_nx_n}{f_1 + f_2 + \dots + f_n}$$

$$\bar{x} = \frac{11000}{200} = 55$$

Mean of Grouped Data (With Class-Interval)

When the data is grouped in the form of class interval then the mean can be calculated by three methods.

1. Direct Method

In this method, we use a midpoint which represents the whole class. It is called the **class mark**. It is the average of the upper limit and the lower limit.

$$\text{Class Mark} = \frac{\text{Upper Class Limit} - \text{Lower Class Mark}}{2}$$

Example

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$$

A teacher marks the test result of the class of 55 students for mathematics. Find the mean for the given group.

Marks of Students	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	27	10	7	5	4	2

To find the mean we need to find the mid-point or class mark for each class interval which will be the x and then by multiplying frequency and midpoint we get fx .

Marks of students	Frequency(f)	Midpoint(x)	fx
0 - 10	27	5	135
10 - 20	10	15	150
20 - 30	7	25	175
30 - 40	5	35	175
40 - 50	4	45	180
50 - 60	2	55	110
		$\sum f = 55$	$\sum fx = 925$

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + \dots + f_nx_n}{f_1 + f_2 + \dots + f_n}$$

$$\bar{x} = \frac{925}{55} = 16.8 \text{ marks}$$

2. Deviation or Assumed Mean Method

If we have to calculate the large numbers then we can use this method to make our calculations easy. In this method, we choose one of the x's as **assumed mean** and let it as "a". Then we find the deviation which is the difference of assumed mean and each of the x. The rest of the method is the same as the direct method.

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

Example

If we have the table of the expenditure of the company's workers in the household, then what will be the mean of their expenses?

Expense(Rs.)	100 - 150	150 - 200	200 - 250	250 - 300	300 - 350	350 - 400
Frequency	24	40	33	28	30	22

Solution

As we can see that there are big values of x to calculate so we will use the assumed mean method.

Here we take 275 as the assumed mean.

Expenses(Rs.)	Frequency(f)	Mid value(x)	d = x - 275	fd
100 - 150	24	125	- 150	- 3600
150 - 200	40	175	- 100	- 4000
200 - 250	36	225	- 50	-1650
250 - 300	28	275	0	0
300 - 350	30	325	50	1500
350 - 400	22	375	100	2200
	$\sum f = 180$			$\sum fd = - 5550$

$$\bar{x} = 275 + \frac{-5550}{180}$$

$$= 275 - 30.83$$

$$= 244.17$$