1. Mean

Mean is an *average.*

It is a *measure of central tendency* .

Mean is obtained by adding all the values and by dividing the total by the number of items.

Mean is represented by the symbol $\bar{X}$ (X bar).

Mean is of two types, namely *arithmetic mean* and *geometric mean.*

The average obtained arithmetically is called *arithmetic mean.* Normally arithmetic mean is simply called *mean.*

Geometric mean is obtained by geometric progression.

Mean can be obtained for *ungrouped* and *grouped data.*

The mean can be calculated by two methods, namely-

1. Direct method

2. Indirect method or Assumed mean method.

In *direct method*, mean is calculated for ungrouped data by the following formula:

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

$\overline{X}$ = Mean

Σ = Sum of

X = Value of an items

N = Total number of items

In *indirect method*, mean is calculated for ungrouped data by the following formula:

$$\overline{X} = A \pm \frac{\Sigma d}{N}$$

$\overline{X}$ = Mean

A = Assumed mean

d = Deviation from assumed mean

Σd = Sum of d

N = Number of items

For grouped data, mean is calculated by the following formula:

$$\overline{X} = \frac{\Sigma fx}{\Sigma f} \quad \text{or} \quad \overline{X} = \frac{\Sigma fm}{\Sigma f}$$

$\overline{X}$ = Mean

X = Value of an item

Σ = Sum of

f = Frequency

m = Class mark

N = Number of items

Merits of Mean

1. Mean is well defined.
2. Calculation is easy.
3. All the items are considered for calculation.
4. It is based on each and every observation.
5. It is used for other statistical calculations.

Demerits of Mean

1. Mean will not be correct if certain values are very big or very small.
2. It may give false conclusion.
3. It gives absured values. For example, the mean children in families is given sometimes as 2½ children.

Problem 1 :

The weight of 10 fishes in gms is given below. Find the mean by direct method and assumed mean method.

Sl. No	1	2	3	4	5	6	7	8	9	10
Weight	12	15	11	19	16	20	14	20	12	11

Direct Method

1. It is an *ungrouped data.*
2. Add all the values to find Σx.
3. Divide the Σx by the total number of items.

$$\text{Mean } \overline{X} == \frac{\Sigma x}{N} \qquad \Sigma x = 150 \\ N = 10$$

$$== \frac{150}{10}$$

$$\text{Mean} = 15 \text{ gms}$$

2. Assumed Mean Method

(If calculator is not available, follow this method).
1. It is an *ungrouped data.*
2. Draw a table with two vertical columns.
3. Write the values in the first column.
4. Consider the value of an item, as assumed mean(A).
5. Find out the deviation (d) difference of each value from the assumed mean (X - A).
6. Add all the deviations to get Σd.
7. Apply the formula:

Weight of fishes (x)	$d = X - A$ $= X - 16$
12	12 - 16 = - 4
15	15 - 16 = - 1
11	11 - 16 = - 5
19	19 - 16 = 3
(16) A	16 - 16 = 0
20	20 - 16 = 4
14	14 - 16 = - 2
20	20 - 16 = 4
12	12 - 16 = - 4
11	11 - 16 = - 5
	- 21 + 11 $\Sigma d = -10$

$$\overline{X} = A \pm \left(\frac{\Sigma d}{N}\right)$$

$$= 16 \pm \left(\frac{-10}{10}\right)$$

$$= 16 \pm (-1)$$
$$= 16 - 1 = 15 \text{gms}$$

Answer: Mean = 15 gms

Problem 2:

Calculate mean for the following data:

Weight of fishes	6	7	8	9	10	11
Number of fishes	15	17	20	16	19	13

1. Direct Method

1. It is a **grouped data** without class interval.
2. Draw a table with three vertical columns.
3. Weight of fishes is given in the first column.

Weight (x)	Number of fishes (f)	fx
6	15	15 x 6 = 90
7	17	17 x 7 = 119
8	20	20 x 8 = 160
9	16	16 x 9 = 144
10	19	19 x 10 = 190
11	13	13 x 11 = 143
	$\Sigma f = 100$	$\Sigma fx = 846$

4. The frequency (number of fishes) is given in the second column.

5. Multiply the weight by the frequency to get fx and enter in the third column.

6. Add all the fx to get Σfx.

7. Divide the Σfx by the total number of fishes to find mean.

$$\overline{X} = \frac{\Sigma fx}{\Sigma f}$$

$\overline{X}$ = Mean

Σ = Sum

$$= \frac{846}{100}$$

f = Frequency

x = Weight

Answer: Mean = 8.46 gms

Problem 3 : Find the mean for the following data:

Weight of fishes (x)	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Number of fishes (f)	15	17	16	19	13

1. Direct Method

1. It is a *grouped data with class interval*.

2. A table with four vertical columns is drawn.

3. Weight of fishes (x, classes) is entered in the first column.

4. Class mark or mid - value (m) of each class is calculated and entered in the second column. It is calculated by adding the lower limit and upper limit of each class and dividing it by 2.

5. Enter the number of fishes (f) in the third column. Add the values to get Σf and enter at the bottom.

6. Find the *mf* by multiplying the mid value and frequency and enter in the last column.

7. Add the values of mf to get Σmf and enter at the bottom.

Weight of fishes (classes)	Mid - value (class mark) (m)	Number of fishes (f)	fm
10 - 20	$10 + 20 = \dfrac{30}{2} = 15$	15	$15 \times 15 = 225$
20 - 30	$20 + 30 = \dfrac{50}{2} = 25$	17	$25 \times 17 = 425$
30 - 40	$30 + 40 = \dfrac{70}{2} = 35$	16	$35 \times 16 = 560$
40 - 50	$40 + 50 = \dfrac{90}{2} = 45$	19	$45 \times 19 = 855$
50 - 60	$50 + 60 = \dfrac{110}{2} = 55$	13	$55 \times 13 = 715$
		$\Sigma f = 80$	$\Sigma mf = 2780$

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

$$= \frac{2780}{80}$$

Mean = 34.75 gms

$\bar{X}$ = mean
Σ = Sum of
m = mid value or class mark
f = Frequency
N = Number of fishes, Σf

2. Assumed Mean method

    1. It is a grouped data with class interval.
    2. A table with six vertical columns is drawn.
    3. Enter the weight of fishes (x, classes) in the first column.
    4. Enter mid - value of each class in the second column.

Class	Class mark (m)	Frequency (f)	Deviation $d = m - A$ $A = 45$	fd $(f \times d)$
10- 20	$10+20=\dfrac{30}{2}=15$	15	$15-45=-30$	- 450
20- 30	$20+30=\dfrac{50}{2}=25$	17	$25-45=-20$	- 340
30- 40	$30+40=\dfrac{70}{2}=35$	16	$35-45=-10$	- 160
40- 50	$40+50=\dfrac{90}{2}=$ ⑤	19	$45 - 45= 0$	0
50- 60	$50+60=\dfrac{110}{2}=55$	13	$55-45= 10$	130
		$\Sigma f = 80$		130-950 $\Sigma fd = -820$

$$\bar{X} = A \pm \dfrac{\Sigma fd}{N}$$

$$= 45 - \dfrac{-820}{80}$$

$$= 45 - 10.25$$

$$= 34.75 gms$$

Answer: Mean = 34.75 gms.

$\bar{X} = $ Mean

$A = $ Assumed mean $= 45$

$\Sigma = $ Sum of

$f = $ Frequency

$d = $ Deviation

$N = $ Number of observations Σf

5. Select an assumed mean (A) from the mid-value. Usually mid-value of the class having highest frequency is selected. Here it is 45.

6. Find the deviations(d) for each value from the asssumed mean (X-A) and enter in the third column.

60

7. Enter frequency (*f*) in the fourth column.
8. Multiply the deviation with frequency (fxd = *fd*) to get *fd* and enter in the sixth column.
9. Add all *fd* to get *Σfd* and enter at the bottom.
10. Apply the formula.

Types of Mean

Mean is *the average.* It is a *value of central tendency.*
Mean is of three types, namely
1. Arithmetic mean
2. Geometric mean
3. Harmonic mean.

1. Arithmetic Mean

Arithmetic mean is an *average obtained arithmetically.*
It is the common average used in our day today life.It is commonly called 'mean'. It is represented as x (x bar).
. It is calculated by adding all the values and dividing the sum by the total number of items.
The simple formula for the calculation of mean is

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

$\bar{x}$ = Mean (x bar)
Σ = Sum
x = Value
N = Number of items

Merits of Mean
1. Mean is well defined.
2. Calculation is easy.
3. All the items are considered for calculation.
4. It is based on each and every observation.
5. It is used for other statistical calculations.

Demerits of Mean
1. Mean will not be correct if certain values are very big or very small.

Scanned with CamSca

2. It may give false conclusion.

3. It gives absured values. For example, the mean children in families is given sometimes as 2½ children.

2. Geometric Mean

Geometric mean is an *average*. *It is the antilog of the arithmetic average of log of different items in a series.*

It is represented as **GM**.

It is used when dealing with **ratios, indices** or any such relative numbers.

GM is calculated by the following formula:

$$\text{Log GM} = \frac{\Sigma \log x}{N}$$

Merits of Geometric Mean

1. It is highly defined
2. It is based on all the items of the series.
3. It is useful in averages, percentages and ratios.
4. It is useful in economic and business statistics in index number construction.
5. It is used for further methemetical calculation.
6. It is not much affected by fluctuation of sampling.

Demerits

1. It is not easy for an ordinary man.
2. It is difficult to calculate.
3. If there are zeros or negative values in the data, GM cannot be calculated.

Solved Problems

The harvest of coconuts in 5 coconut trees is given below. Find the geometric mean.

$$2, 8, 5, 6, 4$$

$$\text{GM} = (x_1 \times x_2 \times x_3 \times x_4 \times x_5)^{1/n}$$

$$= (2 \times 8 \times 5 \times 6 \times 4)^{1/5}$$

$$\text{GM} = (1920)^{1/5}$$

$$\text{Log GM} = \frac{1}{5} \times \log 1920$$

$$= \frac{1}{5} \times 3.281$$

$$= 0.2 \times 3.281$$

$$= 0.6562.$$

$$\text{GM} = \text{Antilog of } 0.6562.$$

$$= 4.531$$

Answer Gm = 4.531

3. Harmonic Mean

Harmonic mean is the reciprocal of the arithmetic mean of the reciprocals of the individual observations.

It is represented by **HM**.

It is an **average**. It is **a measure of central tendency**.

It is used when dealing with rates and speeds.

It is calculated by the following formula

$$\text{HM} = \frac{N}{\Sigma \, 1/x}$$

N = Number of items

x = Value

Merits of Harmonic Mean

1. All the values are included in calculation.
2. It can be used for further methemetical calculations.
3. It gives better results in problems relating to rates and speeds.
4. It is not affected by sampling fluctuations.

Demerits

1. It is difficult to calculate.
2. It is difficult to understand.
3. It cannot be calculated when some values are in negatives or one value is 0.
4. It gives more weightage to smaller items