14.2 METHOD FOR MEAN OF UNGROUPED DATA

x_i	f_i	$F_1 x_1$
x_1	f_1	$f_1 x_1$
x_2	f_2	$f_2 x_2$
x_3	f_3	$f_3 x_3$
.	.	.
.	.	.
.	.	.
	$\sum f_i =$	$\sum f_1 x_1 =$

Grouped Frequency Distribution (Grouped)

(i) Direct method: for finding mean

Mean $\overline{x} = \dfrac{\sum f_i x_i}{\sum f_u}$

Ex2. Find the missing value of P for the following distribution whose mean is 12.58

x	5	8	10	12	P	20	25
y	2	5	8	22	7	4	2

Sol. Given $\overline{x}$ = 12.58

Calculation of Mean :

x_i	f_i	$f_i x_i$
5	2	10
8	5	40
10	8	80
12	22	264
P	7	7P
20	4	80
25	2	50
	$\sum f_i = 50$	$\sum f_i x_u = 524 + 7P$

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

$$12.58 = \frac{524 + 7P}{50}$$

$629 = 524 + 7P$

$7P = 105$

$P = 15$.

Ex.3 **Find the mean for the following distribution :**

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	6	8	13	7	3	2	1

Sol.

Marks	Mid Values x_i	No. of students f_i	$f_i x_i$
10-20	15	6	90
20-30	25	8	200
30-40	35	13	455
40-50	45	7	345
50-60	55	3	165
60-70	65	2	130
70-80	75	1	75
		$\sum f_i = 40$	$\sum f_i x_i = 1430$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1430}{40} = \frac{143}{4} = 35.75$$

(ii) Deviation Method: (Assumed Mean Method)

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

where,

A = Assumed mean

d_i = Deviation from mean (x_i - A)

Find the mean for the following distribution by using deviation method :

x_i	15	20	22	24	25	30	33	38
Frequency	5	8	11	20	23	18	13	2

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Sol.

x_i	f_i	Let A = 25 $d_i = x_i - 25$	$f_i d_i$
15	5	-10	-50
20	8	-5	-40
22	11	-3	-33
24	20	-1	-20
25	23	0	0
30	18	5	90
33	13	8	104
38	2	13	26
	$\sum f_i = 100$		$\sum f_i d_i = 77$

$$\bar{x} = A + \frac{\sum f_i d_i}{\sum f_i} = 25 + \frac{77}{100} = 25.77$$

(iii) Step - Deviation Method:

$$\bar{x} = A + \left(\frac{\sum f_i u_i}{\sum f_i} \right) h$$

where,

A = Assumed mean $u_i = \dfrac{x_i - A}{h}$, h = Width of class interval

Ex.5 Find the mean of following distribution with step - deviation method :

Class	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	5	6	8	12	6	3

Sol. **Calculation of Mean :**

Class	x_i	f_i	Let A = 27.5 $u_i = \dfrac{x_i - 27.5}{5}$	$f_i u_i$
10-15	12.5	5	-3	-15
15-20	17.5	6	-2	-12
20-25	22.5	8	-1	-8
25-30	27.5	12	0	0
30-35	32.5	6	1	6
35-40	37.5	3	2	6

		$\sum f_i = 40$		$\sum f_i u_i = -23$

$$\Rightarrow \quad \overline{x} = A + \left(\frac{\sum f_i u_i}{\sum f_i} \right) h \quad\quad \Rightarrow \quad \overline{x} = 27.5 + \times \left(\frac{-23}{40} \right) = 24.625$$

Ex. 6 The mean of the following frequency distribution is 62.8 and the sum of all frequencies is 50. Compute the missing frequency f_1 and f_2

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	f_1	10	f_2	7	8

Sol. Let = 30, h = 20

Class	x_i	f_i	$u_i = \dfrac{x_i - A}{h}$	$f_i u_i$
0-20	10	5	-1	-5
20-40	30	f_1	0	0
40-60	50	10	+1	10
60-80	70	f_2	+2	$2f_2$
80-100	90	7	+3	21
100-120	110	8	+4	32
		$\sum f_i = 30 + f_1 + f_2$		$\sum f_i u_i = 58 + 2f_2$

Given $30 + f_1 + f_2 = 50$

$\quad\quad f_1 + f_2 = 20$ ....(i)

$$\overline{x} = A + \left(\frac{\sum f_i u_i}{\sum f_i} \times h \right)$$

$$62.8 = 30 = \left(\frac{58 + 2f_2}{50} \times 20 \right)$$

$$62.8 = (58 + 2f_2) \times \frac{2}{5}$$

$$32.8 \times 5 = 116 + 4f_2$$

$$164 = 116 + 4f_2$$

$$4f_2 = 164 - 116$$

$$4f_2 = 48$$

$$f_2 = 12$$

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Now, $f_1 = f_2 = 20$

$f_1 + 12 = 20$

$f_1 = 8$

So, the missing frequencies are $f_1 = 8$ and $f_2 = 12$.

Ex.7 Find the mean marks from the following data :

Marks	No. of Students
Below 10	5
Below 20	9
Below 30	17
Below 40	29
Below 50	45
Below 60	60
Below 70	70
Below 80	78
Below 90	83
Below 100	85

Sol. Charging less than type frequency distribution in general frequency distribution.

Marks	x_i	f_i	$A = 45, h = 10$ $u_i = \dfrac{x_i - A}{h}$	$f_i u_i$
0-10	5	5	-4	-20
10-20	15	4	-3	-12
20-30	25	8	-2	-16
30-40	35	12	-1	-12
40-50	45	16	0	0
50-60	55	15	+1	15
60-70	65	10	+2	20
70-80	75	8	+3	24
80-90	85	5	+4	20
90-100	95	2	+5	10
		$\sum f_i = 85$		$\sum f_i u_i = 29$

According to step deviation formula for mean

$$\bar{x} = A + \left(\frac{\sum f_i u_i}{\sum f_i} \times h \right)$$

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$$\overline{x} = 45 + \left(\frac{29}{85} \times 10\right)$$

$$\overline{x} = 45 + 3.41$$

$$\overline{x} = 48.41$$

So, the mean marks is 48.41

PROPERTIES OF MEAN:

(i) Sum of deviations from mean is zero. i.e. $\sum_{i=1}^{n}(x_i - \overline{x}) = 0$

(ii) If a constant real number 'a' is added to each of the observation than new mean will be $\overline{x} + a$.

(iii) If a constant real number 'a' is subtracted from each of the observation then new mean will be $\overline{x} - a$.

(iv) If a constant real number 'a' is multiplied with each of the observation then new mean will be $a\overline{x}$.

(v) If each of the observation is divided by a constant no 'a', then new mean will be $\frac{\overline{x}}{a}$.

MERITS OF ARITHETIC MEAN:

(i) It is rigidly defined, simple, easy to understand and easy to calculate.

(ii) It is based upon all the observations.

(iii) Its value being unique, we can use it to compare different sets of data.

(iv) It is least affected by sampling fluctuations.

(v) Mathematical analysis of mean is possible. So, It is relatively reliable.

DEMERITS OF ARITHMETCI MEAN:

(i) It can not be determined by inspection nor it can be located graphically.

(ii) Arithmetic mean cannot be used for qualities characteristics such as intelligence, honesty, beauty etc.

(iii) It cannot be obtained if a single observation is missing.

(iv) It is affected very much by extreme values. In case of extreme items, A.M. gives a distorted picture of the distribution and no longer remains representative of the distribution.

(v) It may lead to wrong conclusions if the details of the data from which it is computed are not given.

(vi) It can not be calculated if the extreme class is open, e.g. below 10 or above 90.
(vii) It cannot be used in the study of ratios, rates etc.

USES OF ARITHMETIC MEAN:
(i) It is used for calculating average marks obtained by a student.
(ii) It is extensively used in practical statistics and to obtain estimates.
(iii) It is used by businessman to find out profit per unit article, output per machine, average monthly income and expenditure etc.