ARITHMETIC MEAN FOR GROUPED DATA

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

where x is mid point of each class

f is frequency with which a particular value (mid-point) is observed in data set.

Short cut method

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

where A is arbitrary value and x is deviation of a mid point from A.

The two are equal and is not difficult to see.

$$\bar{x} = A - A + \frac{\Sigma f x}{\Sigma f} = A + \frac{\Sigma f x}{\Sigma f} - \frac{\Sigma f A}{\Sigma f}$$

$$\left[\because A \text{ is constant } \frac{\Sigma f A}{\Sigma f} = \frac{A \Sigma f}{\Sigma f} = A\right]$$

$$= A + \frac{\Sigma f(x-A)}{\Sigma f} = A + \frac{\Sigma f x'}{\Sigma f}$$

Another such manipulation could be done. Thus,

$$\bar{x} = A + \frac{\Sigma f d}{\Sigma f} \times h$$

where h is class-width and d is $\frac{(x-A)}{h}$

* The above method is known as to be step deviation method.

⇒

class interval	f	x (mid point)	fx
0 - 10	2	5	10
10 - 20	7	15	105
20 - 30	10	25	250
30 - 40	8	35	280
40 - 50	3	45	135
	$\Sigma f = 30$		$\Sigma fx = 780$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{780}{30} = 26.$$

Direct method:-

class-Interval	X	f	d=(X-A)	fd	fd'
	5	2	-20	-40	-4
	15	7	-10	-70	-7
	25=A	10	0	0	0
	35	8	10	80	8
	45	3	20	60	6
		30		30	$\Sigma fd' = 3$

$$\bar{x} = A + \frac{\Sigma fd}{\Sigma f}$$

$$= 25 + \frac{\cancel{30}\,1}{\cancel{30}}$$

$$= 25 + 1 = 26 \text{ Ans.}$$

Step Deviation:

$$\bar{x} = A + \frac{\Sigma fd'}{\Sigma f} \times h =$$

$$= 25 + \frac{3}{30} \times 10 = 25 + \frac{\cancel{30}\,1}{\cancel{30}} = 26$$

CORRECTION OF MEAN:

It sometimes happens that incorrect values are copied and this means that wrong value for mean is calculated. To rectify this error, wrong items are deducted from incorrect ΣX and correct items are added and then corresponding ΣX is divided by number of observations.

1) The mean of 7 items was found to be 14.2. Find the new mean if:

(a) 12 was read as 21

(b) One value 15 was omitted

(c) One value 14 was added by mistake.

Solution:— old mean $= 14.2 = \frac{\Sigma X}{7}$

$$\left[\begin{array}{l} \because \bar{X} = \frac{\Sigma X}{N} \\ \bar{X} \text{ given, } 14.2, \ N = 7. \end{array}\right]$$

$\therefore \Sigma X = 14.2 \times 7 = 99.4$

Thus, old $\Sigma X = 99.4$

(a) New Σx = old Σx − 21 + 12

$= 99.4 - 21 + 12 = 90.4$

New $\bar{x} = \frac{90.4}{7} = 12.914$ Ans.

(b) One value 15 was omitted

New Σx = old $\Sigma x + 15 = 99.4 + 15$

$= 114.4$ $\left[\because N = 7+1 = 8\right]$

New $\bar{x} = \frac{114.4}{8} = 14.3$ Ans.

(c) one value 14 was added by mistake

New Σx = old $\Sigma x - 14$

$= 99.4 - 14$

$= 85.4$

New $\bar{x} = \frac{\Sigma x}{N}$ $\left[N = 7-1 = 6\right]$

$= \frac{85.4}{6} = 14.23$.

$x = 5, 10, 15, 20$

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

$\Sigma x = 5+10+15+20 = 50$

$N = 4$

$$\therefore \bar{x} = \frac{\Sigma x}{N} = \frac{50}{4} = 12.5$$

* Now suppose 40 read as 20

$\therefore$ old $\Sigma x = 50$

New Σx = old $\Sigma x + 40 - 20$

$= 50 + 40 - 20$

$= 90 - 20$

$= 70$

$\therefore$ Corrected mean $= \frac{\Sigma x}{N} = \frac{70}{4}$

$= 17.5$ Ans.