Vidyasagar University

Department of Library and Information Science

Course – Bachelor of Library and Information Science

Paper No: BLI - 202

Paper Name - Management of Libraries and Information Centres – II

Unit – 4: Measurement of Central Tendency

Material No – 02

Properties of Arithmetic Mean:

1) The total of a set of observations is equal to the product of their number and the arithmetic mean.

$\sum x = n\bar{x}$ or $\sum fx = N\bar{x}$

We know that Arithmetic Mean (AM) = $\bar{x} = \frac{\sum x}{n}$ ……..…. (i)

or $\sum x = n\bar{x}$

Arithmetic Mean (AM) = $\bar{x} = \frac{\sum fx}{N}$ …….. (ii)

Or $\sum fx = N\bar{x}$

See example – 1 of Material No - 1

Where $\bar{x}$ = 109, $\sum x$ = 1090, n = 10

$\sum x = n\bar{x}$

1090 = 109 * 10 = 1090

See example – 3 of Material No - 1

Where $\bar{x}$ = 60, $\sum fx$ = 1680, N = 28

$\sum fx = N\bar{x}$

1680 = 28 * 60 = 1680

2) The sum of the deviation of a set of observations from their A M is always zero.

$\sum(xi - \bar{x}) = 0$ where $\bar{x} = \frac{\sum xi}{n}$

$\sum fi(xi - \bar{x}) = 0$ where $\bar{x} = \frac{\sum fix\,i}{N}$

See example – 1 of Material No – 1

Price per book (Rs) (x)	Deviation (xi - $\overline{x}$)	(xi - $\overline{x}$)
75	75 – 109	- 34
80	80 – 109	- 29
110	110 – 109	1
125	125 – 109	16
140	140 – 109	31
90	90 – 109	- 19
150	150 – 109	41
100	100 – 109	- 9
85	85 – 109	- 24
135	135 – 109	26

$\sum(xi - \overline{x})$ = 0 (+115, - 115)

See example – 3 of Material No - 1

No of books issued per day (x)	No of days of the month (f)	fi(xi - $\overline{x}$)	fi(xi - $\overline{x}$)
20	1	1(20-60)	- 40
30	2	2(30-60)	- 60
40	3	3(40-60)	- 60
50	4	4(50-60)	- 40
60	5	5(60-60)	00
70	6	6(70-60)	60
80	7	7(80-60)	140

$\sum fi(xi - \overline{x})$ = 0 (+ 200, - 200)

3) If a group of n_1 observations has A M $\overline{x1}$ and another group of n_2 observations has A M $\overline{x2}$, then the A M ($\bar{x}$) of the composite group of $n_1 + n_2$ (= N, say) observations is given by $N\bar{x} = n_1\ \overline{x1} + n_2\ \overline{x2}$.

Suppose, there are two groups and values of the variable in each group are as follows:

Group A: Price/ book – 70, 90, 120, 140, 180

Group B: Price/ book – 200, 220, 250, 280, 300

For Group A, AM = $\bar{x}_1$ = (70+90+120+140+180)/ 5 = 600/ 5 = 120, where $n_1 = 5$ and

For Group B, AM = $\bar{x}_2$ = (200+220+250+280+300)/ 5 = 1250/ 5 = 250, where $n_2 = 5$.

So, AM of the composite group by following the formula will be –

$N\bar{x} = n_1\ \overline{x1} + n_2\ \overline{x2}$

Or $10\bar{x} = 5 * 120 + 5 * 250$

Or $10\bar{x} = 600 + 1250$

Or $\bar{x} = 1850/10$

Or $\bar{x} = 185$.

Now, AM of the composite group without following the formula is –

$\bar{x}$ = (70+90+120+140+180+200+220+250+280+300)/ 10

= 1850/ 10

= 185.

4) If two variables x and y are so related that $y = \frac{x-c}{d}$ then,

$\bar{x} = c + d\bar{y}$, c = origin, d = scale

See example – 4 of Material No – 1

No of books catalogued/ day (X)	Mid-value (x)	No of days (f)	$y = \frac{x-38}{5}$	(fy)
16-20	18	32	- 4	-128
21-25	23	35	- 3	-105
26-30	28	42	- 2	- 84
31-35	33	48	- 1	- 48
36-40	38	35	0	00

41-45	43	30	1	30
46-50	48	23	2	46
51-55	53	19	3	57
56-60	58	16	4	64

$\sum f$ = N = 280 $\sum fy$ = -168 (197- 365)

Where, c = origin = 38 and d = scale = 5

y = changed value of x after changing its origin and scale of measurement

f = frequency of the variable in each class

N = total number of frequency

Arithmetic mean in respect of y i.e., $\bar{y} = \frac{\sum fy}{N}$ = -168/ 280

So, $\bar{x}$ = c+d$\bar{y}$ = 38+ 5 (- 0.6) = 38 – 3 = 35.

Therefore, following the formula the value of AM will remain unchanged if the values of x are converted into y by changing its origin and scale of measurement.

5 The sum of the squares of deviations of a set of observations has the smallest value, when deviations are taken from their A M.

To prove this property it needs to calculate the average of a particular problem by other types of measurement of central tendency.