

Numerical Analysis and Statistics

Arithmetic mean :-

Formula :-

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

1. Find the arithmetic mean :-

10.5, 5.3, 2.5, 3.8, 4.9

Solution :-

Given that 10.5, 5.3, 2.5, 3.8, 4.9

$$\text{Formula : } \bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

Here,  $n=6$ 

$$\bar{x} = \frac{10.5 + 5.3 + 2.5 + 3.8 + 4.9}{6}$$

$$= \frac{29.7}{6}$$

$$\therefore \bar{x} = 4.95$$

2. Find the arithmetic mean 5.005, 4.8999, 4,

4.677, 3.999, 5.0006

Solution :-

Given that 5.005, 4.8999, 4, 4.677, 3.999,

5.0006

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

Here,  $n=6$ 

$$\bar{x} = \frac{5.005 + 4.8999 + 4 + 4.677 + 3.999 + 5.0006}{6}$$

$$= \frac{27.58}{6}$$

$$\therefore \bar{x} = 4.5969$$

type 2 :-

$$\text{formula :- } \bar{x} = \frac{\sum xf}{\sum f}$$

1. Find the arithmetic mean of the following frequency distribution

x	1	2	3	4	5	6	7
f	15	9	12	17	14	10	6

Solution :-

Given that

x	1	2	3	4	5	6	7
f	5	9	12	17	14	10	6

$$\bar{x} = \frac{\sum xf}{\sum f}$$

$$\text{Here, } \sum xf = 299, \sum f = 73$$

$$\bar{x} = \frac{299}{73}$$

$$\therefore \bar{x} = 4.095$$

$$\Rightarrow \therefore \bar{x} = 4.095$$

Missing value :-

type 1

If the means of the find the following distribution

is 15 Find p.

x	5	10	15	20	25
f	6	p	6	10	5

Solution :-

x	f	$\sum fx$
5	6	30
10	p	10p
15	6	90
20	10	200
25	5	125
	$\sum f =$ 27+p	$\sum fx =$ 445 + 10p

formula :-

$$\text{mean } \bar{x} = \frac{\sum fx}{\sum f}$$

$$15 = \frac{445 + 10p}{27 + p}$$

$$15(27 + p) = 445 + 10p$$

$$405 + 15p = 445 + 10p$$

$$405 + 15p - 445 - 10p = 0$$

$$-40 + 5p = 0$$

$$5p = 40$$

$$p = \frac{40}{5}$$

$\therefore$

$$p = 8$$

3 For a certain frequency table which is only reproduced here the mean was found to be 1.46 the total frequency is 200. Calculate the missing frequency.

$x$	0	3	4	5
$f$	46	25	10	5

Solution :-

$x$	$f$	$fx$
0	46	0
1	$f_1$	$f_1$
2	$f_2$	$2f_2$
3	25	75
4	10	40
5	5	25
	$\Sigma f =$ $86 + f_1 + f_2$	$\Sigma fx =$ $140 + f_1 + 2f_2$

Formula :-

$$\text{mean } \bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$1.46 = \frac{140 + f_1 + 2f_2}{86 + f_1 + f_2} \quad \text{--- (1)}$$

$$86 + f_1 + f_2$$

Total frequency is 200

$$86 + f_1 + f_2 = 200$$

$$f_1 + f_2 = 200 - 86$$

$$\therefore f_1 + f_2 = 114 \quad \text{--- (2)}$$

using (2) in (1) we get

$$1.46 = \frac{140 + f_1 + 2f_2}{114 + 86}$$

$$200 \times 1.46 = 140 + f_1 + 2f_2$$

$$f_1 + 2f_2 = 292 - 140$$

$$f_1 + 2f_2 = 152 \quad \text{--- (3)}$$

$$f_1 + f_2 = 114 \quad \text{--- (2)}$$

$$f_1 + 2f_2 = 152 \quad \text{--- (3)}$$

(-) (-)

$$-f_2 = -38$$

$$\therefore f_2 = 38$$

put  $f_2 = 38$  in equation (2)

$$f_1 + 38 = 114$$

$$\boxed{f_1 = 76}$$

$$(2) \Rightarrow f_1 + f_2 = 114$$

$$76 + f_2 = 114$$

$$\boxed{f_2 = 38}$$

$$\text{so, } \boxed{f_1 = 76} \quad \boxed{f_2 = 38}$$

## Weight Arithmetic Mean.

If  $w_1, w_2, w_3, \dots, w_n$  are the weights associated with the items  $x_1, x_2, \dots, x_n$  then

A.M is called weighted A.M =  $\frac{\sum wx}{\sum w}$

1. Find the weighted A.M from the data

Name of Book	Cost	No. of Books
Thirukkural	RS. 10	20
epethai	RS. 8	15
Bible	RS. 5	15

Solution :

W	x	wx
20	10	200
15	8	120
15	5	75
$\sum w = 50$		$\sum wx = 395$

Formula :-  $\bar{x} = \frac{\sum wx}{\sum w}$



b) The following table gives the marks student class in examination and weights attached to each subject

subject	Eng	Maths	so. science	Hindi	Science
weight	2	3	3	1	1
marks	62	83	80	60	55

Find the weight A.M

Solution :-

$w$	$x$	$wx$
2	62	124
3	83	249
3	80	240
1	60	60
1	55	55
$\Sigma w = 10$		$\Sigma wx = 728$

formula :-

$$\bar{x} = \frac{\Sigma wx}{\Sigma w}$$

$$= \frac{728}{10}$$

$$\therefore \bar{x} = 72.8$$

## Median

type 1

1. Find the median value for the following  
2, 4, 6, 8, 10, 12, 14.

Solution :-

Arrange Ascending order

2, 4, 6, 8, 10, 12, 14

Formula:  $\left(\frac{n+1}{2}\right)^{\text{th}}$  term.

$\left(\frac{7+1}{2}\right)^{\text{th}}$  term

$\left(\frac{8}{2}\right)^{\text{th}}$  term

4<sup>th</sup> term = 8

2. To find the median value:-

2, 4, 6, 8, 10, 12, 14, 16

Solution:-

Arrange Ascending order

2, 4, 6, 8, 10, 12, 14, 16

median value

$$\left(\frac{n+1}{2}\right) = \frac{8+10}{2} = \frac{18}{2} = 9$$

median value is 9

3. 3, 5, 1, 6, 2

Solution:-

Arrange Ascending order

1, 2, 3, 5, 6

median value is 3

4. 2, 8, 1, 7, 6, 3, 9, 10.

Solution :- Arrange ascending order.

1, 2, 3, 6, 7, 8, 9, 10.

$$\left(\frac{n+1}{2}\right) = \left(\frac{6+7}{2}\right) = \frac{13}{2} = 6.5$$

type II

1. calculate the median value from the following

table.

x	1	2	3	4	5	6	7	8	9
f	8	10	11	16	20	25	15	9	6

Solution :-

$$\frac{N}{2} = \frac{\sum f}{2} = \frac{120}{2} = 60$$

x	f	c.f.
1	8	8
2	10	18
3	11	29
4	16	45
5	20	65
6	25	90
7	15	105
8	9	114
9	6	120
	$\sum f = 120$	$\sum c.f. = 594$

median value is 5.11

5 calculate the median form the following.

c.i	5-12	12-19	19-26	26-33	33-40	40-48
f	3	6	12	16	8	5

solution :-

$$\frac{N}{2} = \frac{\sum f}{2} = \frac{50}{2} = 25$$

x	f	c.f
5-12	3	3
12-19	6	9
19-26	12	21
26-33	16	37
33-40	8	45
40-48	5	50
	$\sum f =$ 50	$\sum c.f =$ 165

formula:  $d + \frac{h}{f} \left( \frac{N}{2} - c \right)$

$$= 26 + \frac{7}{16} \left( \frac{50}{2} - 21 \right)$$

$$= 26 + \frac{7}{16} \left( \frac{450 - 42}{2} \right)$$

$$= 26 + \frac{7}{16} \left( \frac{81}{2} \right)$$

$$= 26 + \frac{7}{16} (4)$$

$$= 26 + \frac{7}{4}$$

$$= 26 + 1.75$$

$$\text{median} = 27.75$$

$$d = 26$$

$$N = 50$$

$$h = 7$$

$$f = 16$$

$$c = 21$$

## Standard deviation ( $\sigma$ )

1. Calculate the following standard deviation.

14, 22, 9, 15, 20, 17, 12, 11.

Solution :-

Given that  $x = 14, 22, 9, 15, 20, 17, 12, 11$ .

$$\bar{x} = \frac{\sum x}{N} = \frac{120}{8} \text{ so, } \boxed{\bar{x} = 15}$$

(N = Number of terms)

$x$	$x - \bar{x}$	$(x - \bar{x})^2$
14	-1	1
22	7	49
9	-6	36
15	0	0
20	5	25
17	2	4
12	-3	9
11	-4	16

$$\text{formula} \Rightarrow \sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

$$= \sqrt{\frac{140}{8}}$$

$$= \sqrt{17.5}$$

$$\boxed{\sigma = 4.18}$$

$$\sum (x - \bar{x})^2 = 140$$

1. Find the mean, median, mode for the following frequency distribution:-

x	1	2	3	4	5	6	7
f	5	8	9	10	9	8	5

Solution:-

$$\text{mean } \bar{x} = \frac{\sum xf}{\sum f} = \frac{216}{54} = 4$$

$$\therefore \text{mean} = 4$$

median

x	f	c.f
1	5	5
2	8	13
3	9	22
4	10	32
5	9	41
6	8	49
7	5	54
	$\sum f = 54$	$\sum cf = 216$

$$\frac{N}{2} = \frac{\sum f}{2} = \frac{54}{2} = 27 \quad \therefore \text{median} = 4$$

$$\text{mode} \Rightarrow f_1 = 10, f_0 = 9, f_2 = 9, d = 4, h = 0$$

$$\text{formula:- } d + \left( \frac{h(f_1 - f_0)}{2f_1 - f_0 - f_2} \right) \quad \text{so, that}$$

$$= 4 + \left( \frac{0(10 - 9)}{2(10) - 9 - 9} \right)$$

$$= 4 + \left( \frac{0}{20 - 9 - 9} \right) = 4$$

$$\text{mean} = 4$$

$$\text{median} = 4$$

$$\text{mode} = 4$$