Tutorial - 1 (CO : 4)

Q.1 Marks obtained by 9 students in statistics are given below.

52 75 40 70 43 65 40 35 48

calculate the arithmetic mean.

→ Arithmetic mean

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

Here, $n = 9$

$$= \frac{52 + 75 + 40 + 70 + 43 + 65 + 40 + 35 + 48}{9}$$

$$= \frac{468}{9}$$

$$\boxed{\bar{x} = 52}$$

Q.2 Calculate the arithmetic mean of the following distribution

Variate	6	7	8	9	10	11	12
Frequency	20	43	57	61	72	45	39

→ $$A.M. = \frac{\sum_{i=1}^{k} f_i x_i}{N}$$

where, $N = \sum_{i=1}^{k} f_i$

x_i	f_i	$f_i x_i$
6	20	120
7	43	301
8	57	456
9	61	549
10	72	720
11	45	495
12	39	468
$\Sigma x_i = 63$	$\Sigma f_i = 337$	$\Sigma f_i x_i = 3109$

$$A.M. = \frac{\sum_{i=1}^{k} f_i x_i}{N} = \frac{3109}{337}$$

A. M. = 9.23

Q:3 Find the mean of the following distribution

variable :	0-10	10-20	20-30	30-40	40-50
Frequency :	31	44	39	58	12

class	Mid value x_i	f_i	$d_i = x_i - A$	$f_i d_i$
0-10	5	31	-20	-620
10-20	15	44	-10	-440
20-30	A = 25	39	0	0
30-40	35	58	10	580
40-50	45	12	20	240
		$\Sigma f_i = 184$		$\Sigma f_i d_i = -240$

Shoot cut Method

Let us assume $A = 25$

$$M = A + \frac{\sum_{i=1}^{k} f_i d_i}{N} \quad \text{where } N = \sum_{i=1}^{k} f_i$$

$$M = 25 + \frac{(-240)}{184}$$

$$= 25 - \frac{240}{184}$$

$$= 25 - 1.30$$

$$\boxed{M = 23.7}$$

Q:4 The grouped frequency table shows the length of service in years of employees who have been working for a company for at least ten years.

Calculate an estimate of the standard deviation of the length of service of these employees.

Length of service (x)	$10 \leq x < 15$	$15 \leq x < 20$	$20 \leq x < 25$	$25 \leq x < 30$	$30 \leq x < 40$	$40 \leq x < 50$
Frequency (f)	30	42	23	13	8	4

length of service	Mid interval Value (x)	f	fx	fx^2	fx^2
$10 \leq x < 15$	12.5	30	375	156.25	4687.5
$15 \leq x < 20$	17.5	42	735	306.25	12862.5
$20 \leq x < 25$	22.5	23	517.5	506.25	11643.75
$25 \leq x < 30$	27.5	13	357.5	756.25	9831.25
$30 \leq x < 40$	~~32.5~~ 35	8	280	1225	9800
$40 \leq x < 50$	45	4	180	2025	8100
		$\Sigma f = 120$	$\Sigma fx = 2445$		$\Sigma fx^2 = 56925$

Mean $\bar{x} = \dfrac{\Sigma fx}{\Sigma f}$

$= \dfrac{2445}{120}$

$\bar{x} = 20.375$

Variance $\sigma^2 = \dfrac{\Sigma fx^2}{N} - \bar{x}^2$

$= \dfrac{56925}{120} - (20.375)^2$

$= 474.375 - 415.140$

$\sigma^2 = 59.235$

S.D. $= \sqrt{\sigma^2} = \sqrt{59.235}$

S.D. $= 7.6964$

Q:5 Find an estimate of the standard deviation of the following:

1. a) Life time (hours) of components | Frequency

$300 \leq l < 400$	13
$400 \leq l < 500$	25
$500 \leq l < 600$	66
$600 \leq l < 700$	58
$700 \leq l < 800$	38

Life time (hours) of components	x	f	fx	x^2	fx^2
$300 \leq l < 400$	350	13	4550	122500	1592500
$400 \leq l < 500$	450	25	11250	202500	5062500
$500 \leq l < 600$	550	66	36300	302500	19965000
$600 \leq l < 700$	650	58	37700	422500	24505000
$700 \leq l < 800$	750	38	28500	562500	21375000
		$N=200$	$\Sigma fx = 118300$		$\Sigma fx^2 = 72500000$

Variance $\sigma^2 = \frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2$

$= \frac{72500000}{200} - \left(\frac{118300}{200}\right)^2$

$= 362500 - 349872.25$

$= 12627.75$

S.D. $= \sqrt{12627.75}$

S.D. $= 112.3732$ hours

b) Income (1000's £) Frequency

$10 \leq i < 15$	9
$15 \leq i < 20$	16
$20 \leq i < 25$	22
$25 \leq i < 30$	8
$30 \leq i < 35$	5

Income (1000's £)	x	f	fx	x^2	fx^2
$10 \leq i < 15$	12.5	9	112.5	156.25	1406.25
$15 \leq i < 20$	17.5	16	280	306.25	4900
$20 \leq i < 25$	22.5	22	495	506.25	11137.5
$25 \leq i < 30$	27.5	8	220	756.25	6050
$30 \leq i < 35$	32.5	5	162.5	1056.25	5281.25
		$\Sigma f = 60$	$\Sigma fx = 1270$		$\Sigma fx^2 = 28775$

$$\text{variance} = \frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2$$

$$= \frac{28775}{60} - \left(\frac{1270}{60}\right)^2$$

$$= 479.58 - 448.02$$

$$\sigma^2 = 31.56$$

$$\text{S.D.} = 1000 \times \sqrt{\sigma^2}$$

$$= 1000 \times \sqrt{31.56}$$

$$= 1000 \times 5.617$$

S.D. = £5617

c) House prices (1000's £) Frequency

$40 \leq p < 60$	5
$60 \leq p < 80$	9
$80 \leq p < 100$	15
$100 \leq p < 120$	8
$120 \leq p < 140$	3

House prices (1000's £)	x	f	fx	x^2	fx^2
$40 \leq p < 60$	50	5	250	2500	12500
$60 \leq p < 80$	70	9	630	4900	44100
$80 \leq p < 100$	90	15	1350	8100	121500
$100 \leq p < 120$	110	8	880	12100	96800
$120 \leq p < 140$	130	3	390	16900	50700
		$N = 40$	$\Sigma fx = 3500$		$\Sigma fx^2 = 325600$

$$\text{Variance} = \frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2$$

$$= \frac{325600}{40} - \left(\frac{3500}{40}\right)^2$$

$$= 8140 - 7656.25$$

$$\sigma^2 = 483.75$$

$$\text{S.D.} = \sqrt{\sigma^2} \times 1000 \text{ £}$$

$$= \sqrt{483.75} \times 1000$$

S.D. = £ 21994