→ ULTIMATE MATHEMATICS: BY AJAY MITTAL →

CHAPTER: STATS. | CLASS NO: 2 |

Ques: 1 The mean and variance of 5 observations are 4.4 and 8.24. If three of the observations are 1, 2 and 6. Find the other two observations.

Soln Let the two observations are x and y

∴ data: 1, 2, 6, x, y

$n = 5$

Mean = 4.4

$4.4 = \dfrac{\Sigma x}{n}$

$4.4 = \dfrac{1+2+6+x+y}{5}$

⟹ $22 = 9 + x + y$

⟹ $\boxed{x+y = 13}$ — (i)

$y = 13 - x$

Variance = 8.24

$8.24 = \dfrac{1}{n}\Sigma x^2 - (\text{Mean})^2$

$8.24 = \dfrac{1}{5}\left(1+4+36+x^2+y^2\right) - (4.4)^2$

$8.24 = \dfrac{1}{5}\left(41+x^2+y^2\right) - 19.36$

$27.60 = \dfrac{1}{5}\left(41+x^2+y^2\right)$

$138 = 41 + x^2 + y^2$

$\boxed{x^2 + y^2 = 97}$ — ②

$x^2 + (13-x)^2 = 97$

$x^2 + 169 + x^2 - 26x - 97 = 0$

$2x^2 - 26x + 72 = 0$

$x^2 - 13x + 36 = 0$

$(x-4)(x-9) = 0$

$x = 4, \quad x = 9$

$y = 9, 4$

∴ other two observations are 4 & 9 or 9 & 4

An.

Qn.2 Given that $\bar{x}$ is the mean and σ^2 is the variance of n observations $x_1, x_2, x_3 \cdots x_n$ find the new variance and new mean if each ~~observation~~ observation is multiplied by a number 'k'

Soln

old Mean $= \bar{x} = \dfrac{\Sigma x}{n}$

old variance $= \sigma^2 = \dfrac{1}{n}\Sigma x^2 - (Mean)^2 = \dfrac{1}{n}\Sigma(x-\bar{x})^2$

old observation $= x : x_1, x_2, x_3 \cdots x_n$

New observation $: y : kx_1, kx_2, kx_3 \cdots kx_n$

New Mean $= \dfrac{kx_1 + kx_2 + kx_3 + \cdots kx_n}{n}$

$= \dfrac{k(x_1 + x_2 + x_3 \cdots x_n)}{n}$

$= \dfrac{k\Sigma x}{n}$

$\boxed{\bar{y} = k\bar{x}}$

New variance $= \dfrac{1}{n}\Sigma(y-\bar{y})^2$

$= \dfrac{1}{n}\Sigma(kx - k\bar{x})^2$

$= \dfrac{1}{n}k^2\Sigma(x-\bar{x})^2$

$= k^2 \boxed{\dfrac{1}{n}\Sigma(x-\bar{x})^2}$

$\boxed{\text{New variance} = k^2\sigma^2} = k^2 \times \text{old variance}$

Topic 3 Coefficient of variation (C.V)

$$C.V = \frac{S.D}{Mean} \times 100 \qquad \Rightarrow \qquad C.V = \frac{\sigma}{\bar{X}} \times 100$$

2 groups

I	II
n_1	n_2
$\bar{X_1}$	$\bar{X_2}$
σ_1	σ_2
$C.V_1 = \frac{\sigma_1}{\bar{X_1}} \times 100$	$C.V_2 = \frac{\sigma_2}{\bar{X_2}} \times 100$

• If $C.V_1 > C.V_2$ then group I is more variable (or) has greater variability

(or) group II is more consistent / stable / uniform

Qns 3

	Height	Weight
Mean	162.9 cm	52.36 kg
Variance	127.69 cm²	23.1361 kg²

Show that weights has more variability than height

Soln:

```
    1 . 3
1 | 127.69
    1
21| 027
    21
223| 669
     669
σ₁ = 11.3
```

```
    4 . 8 1
4 | 23.1361
    16
88| 713
    704
961| 961
      961
σ₂ = 4.81
```

$C.V_1 = \frac{11.3}{162.9} \times 100$

$C.V_1 =$

$C.V_2 =$

Q.4 If each observation $x_1, x_2, x_3 \cdots x_n$ are increased by a, show that variance remains unchanged.

Sol

Old observation : $x : x_1, x_2, x_3 \cdots x_n$

old Mean : $\bar{x} = \dfrac{\Sigma x}{n}$

old variance : $\sigma^2 = \dfrac{1}{n} \Sigma (x - \bar{x})^2$

New observation : $y : x_1 + a, x_2 + a, \cdots\cdots x_n + a$

New Mean $\bar{y} = \dfrac{\Sigma y}{n} = \dfrac{\Sigma (x + a)}{n}$

$= \dfrac{\Sigma x + \Sigma a}{n}$

$= \dfrac{\Sigma x}{n} + \dfrac{an}{n}$

$$\boxed{\bar{y} = \bar{x} + a}$$

New variance $= \dfrac{1}{n} \Sigma (y - \bar{y})^2$

$= \dfrac{1}{n} \Sigma (x + a - \bar{x} - a)^2$

$= \dfrac{1}{n} \Sigma (x - \bar{x})^2$

$= \sigma^2$

$\boxed{\text{New variance} = \text{old variance}}$ proved

WORKSHEET No. 2 (STATS)

Qu. 1 The mean and variance of eight observations are 9 and 9.25 respectively. If Six of the observations are 6, 7, 10, 12, 12 and 13. Find the remaining two observations. **Ans** 4 & 8

Qu. 2 → The mean and Standard observation of Six observations are 8 and 4 respectively. If each observation is multiplied by 3. Find the new mean and new Standard deviation of the resulting observations. **Ans** 24, 12

Qu. 3 → C.V of two distributions are 60 and 70 and their Standard deviations are 21 and 16 respectively. what are their arithmetic mean. **Ans** 35 & 22·85

Qu. 4 →

	Firm A	Firm B
No of workers	586	648
Mean Monthly wages	5253	5253
variance	100	121

(i) which from A or B pays larger amount as monthly wages?

(2) which from A or B Shows greater variability?

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