RD Sharma Solutions Class 11 Maths Chapter 32 Ex 32.7

Statistics Ex 32.7 Q1

We observe that the average monthly wages in both firms is same i.e. Rs. 2500. Therefore the plant with greater variance will have greater variability. Thus plant B has greater variability in individual wages.

Statistics Ex 32.7 Q2

We observe that the average weights and heights for the 50 students is same i.e. 63.2.
Therefore, the parameter with greater variance will have more variability.
Thus, *height* has greater variability than weights.

Statistics Ex 32.7 Q3

Coefficient of variation = $\frac{\sigma}{\overline{X}} \times 100$

So, we have:

$$60\% = \frac{21}{\overline{X}} \times 100 \Rightarrow \overline{X} = \frac{21}{.60} \times 100 = 35$$

$$70\% = \frac{16}{\overline{X}} \times 100 \Rightarrow \overline{X} = \frac{16}{.70} \times 100 = 22.85$$

Statistics Ex 32.7 Q4

CI	f	x	u=(x-A)/h	fu	u^2	fu^2
1000-1700	12	1350	-2	-24	4	48
1700-2400	18	2050	-1	-18	1	18
2400-3100	20	2750	0	0	0	0
3100-3800	25	3450	1	25	1	25
3800-4500	35	4150	2	70	4	140
4500-5200	10	4850	3	30	9	90
	120			83		321

Here, $N = 120, A = 2750, \sum f_i u_i = 83, \sum f_i u_i^2 = 321$ and $h = 700$

$$\therefore \quad \text{Mean} = \overline{x} = A + h\left(\frac{1}{N}\sum f_i u_i\right)$$

$$\Rightarrow \quad \overline{x} = 2750 + 700\left(\frac{83}{120}\right) = 3234.17$$

$$\text{var}(x) = h^2\left[\frac{1}{N}\sum f_i u_i^2 - \left(\frac{1}{N}\sum f_i u_i\right)^2\right] = 490000\left[\frac{321}{120} - \left(\frac{83}{120}\right)^2\right] = 1076332.64$$

$$\therefore \quad S.D. = \sqrt{\text{var}(x)} = \sqrt{1076332.64} = 1037.46$$

$$\text{Coefficient of variation } = \frac{S.D}{\overline{X_1}} \times 100 = \frac{1037.46}{3234.17} \times 100 = 32.08$$

Statistics Ex 32.7 Q5

(i)

Total wages paid by firm A = (Average wages) $\times$(Number of employees)

$= 52.5 \times 587 =$ Rs 30817.50

Total wages paid by firm B = (Average wages) $\times$(Number of employees)

$= 47.5 \times 648 =$ Rs 30780

So, firm A pays higher total wages.

(ii)

In order to compare the variability of wages among the two firms, we have to calculate their coefficients of variation.

Let σ_1 and σ_2 denote the standard deviations of Firm A and Firm B respectively. Further, let $\overline{X_1}$ and $\overline{X_2}$ be the mean wages in firms A and B respectively.

We have,

$$\overline{X_1} = 52.5, \qquad \overline{X_2} = 47.5$$

$$\sigma_1^2 = 100 \qquad \text{and} \qquad \sigma_2^2 = 121$$

$$\Rightarrow \quad \sigma_1 = \sqrt{100} = 10 \qquad \text{and} \qquad \sigma_2 = \sqrt{121} = 11$$

Now,

$$\text{Coefficient of variation in wages in firm A} = \frac{\sigma_1}{\overline{X_1}} \times 100$$

$$= \frac{10}{52.5} \times 100 = 19.05$$

and,

$$\text{Coefficient of variation in wages in firm B} = \frac{\sigma_2}{\overline{X_2}} \times 100$$

$$= \frac{11}{47.5} \times 100 = 23.16$$

Clearly, coefficient of variation in wages is greater for firm B than for firm A.
So, firm B shows more variability in wages.

Statistics Ex 32.7 Q6

In order to compare the variability of weight in boys and girls, we have to calculate their coefficients of variation.
Let σ_1 and σ_2 denote the standard deviations of weight in boys and girls respectively. Further, let $\overline{X_1}$ and $\overline{X_2}$ be the mean weight of boys and girls respectively.
We have,

$$\overline{X_1} = 60, \qquad \overline{X_2} = 45$$

$$\sigma_1^2 = 9 \text{ and } \sigma_2^2 = 4$$

$$\Rightarrow \quad \sigma_1 = \sqrt{9} = 3 \quad \text{and} \quad \sigma_2 = \sqrt{4} = 2$$

Now,

$$\text{Coefficient of variation in weights in boys} = \frac{\sigma_1}{\overline{X_1}} \times 100$$

$$= \frac{3}{60} \times 100 = 5$$

and,

$$\text{Coefficient of variation in weights in girls} = \frac{\sigma_2}{\overline{X_2}} \times 100$$

$$= \frac{2}{45} \times 100 = 4.44$$

Clearly, coefficient of variation in weights is greater in boys than in girls.
So, weights shows more variability in boys.

Statistics Ex 32.7 Q7

In order to compare the variability of marks in Math, Physics, and Chemistry, we have to calculate their coefficients of variation.

Let σ_1, σ_2 and σ_3 denote the standard deviations of marks in Math, Physics and Chemistry respectively.
Further, let $\overline{X_1}$, $\overline{X_2}$ and $\overline{X_3}$ be the mean scores in Math, Physics and Chemistry respectively.
We have,

$$\overline{X_1} = 42, \quad \overline{X_2} = 32 \quad \overline{X_3} = 40.9$$

$$\Rightarrow \quad \sigma_1 = 12 \quad \sigma_2 = 15 \quad \sigma_3 = 20$$

Now,

$$\text{Coefficient of variation in Maths} = \frac{\sigma_1}{\overline{X_1}} \times 100 = \frac{12}{42} \times 100 = 28.57$$

$$\text{Coefficient of variation in Physics} = \frac{\sigma_2}{\overline{X_2}} \times 100 = \frac{15}{32} \times 100 = 46.88$$

$$\text{Coefficient of variation in Chemistry} = \frac{\sigma_2}{\overline{X_2}} \times 100 = \frac{20}{40.9} \times 100 = 48.90$$

Clearly, coefficient of variation in marks is greatest in Chemistry and lowest in Math.
So, marks in chemistry show highest variability and marks in maths show lowest variability.

Statistics Ex 32.7 Q8

Let's first find the coefficient of variable for Group G_1

CI	f	x	u=(x-A)/h	fu	u^2	fu^2
10-20	9	15	-3	-27	9	81
20-30	17	25	-2	-34	4	68
30-40	32	35	-1	-32	1	32
40-50	33	45	0	0	0	0
50-60	40	55	1	40	1	40
60-70	10	65	2	20	4	40
70-80	9	75	3	27	9	81
	150			-6		342

Here, $N = 150, A = 45, \Sigma f_i u_i = -6, \Sigma f_i u_i^2 = 342$ and $h = 10$

$\therefore$ Mean $= \bar{x} = A + h\left(\frac{1}{N}\Sigma f_i u_i\right)$

$\Rightarrow$ $\bar{x} = 45 + 10\left(\frac{-6}{150}\right) = 44.6$

$$\text{var}(x) = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right] = 100\left[\frac{342}{150} - \left(\frac{-6}{150}\right)^2\right] = 227.84$$

$\therefore$ $S.D. = \sqrt{\text{var}(x)} = \sqrt{227.84} = 15.09$

Coefficient of variation $= \frac{S.D}{\bar{X}_1} \times 100 = \frac{15.09}{44.6} \times 100 = 33.83$

Now, let's find the coefficient of variable for Group G_2

CI	f	x	u=(x-A)/h	fu	u^2	fu^2
10-20	10	15	-3	-30	9	90
20-30	20	25	-2	-40	4	80
30-40	30	35	-1	-30	1	30
40-50	25	45	0	0	0	0
50-60	43	55	1	43	1	43
60-70	15	65	2	30	4	60
70-80	7	75	3	21	9	63
	150			-6		366

Here, $N = 150, A = 45, \Sigma f_i u_i = -6, \Sigma f_i u_i^2 = 366$ and $h = 10$

$\therefore$ Mean $= \bar{x} = A + h\left(\frac{1}{N}\Sigma f_i u_i\right)$

$\Rightarrow$ $\bar{x} = 45 + 10\left(\frac{-6}{150}\right) = 44.6$

$$\text{var}(x) = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right] = 100\left[\frac{366}{150} - \left(\frac{-6}{150}\right)^2\right] = 243.84$$

$\therefore$ $$S.D. = \sqrt{\text{var}(x)} = \sqrt{227.84} = 15.62$$

$$\text{Coefficient of variation } = \frac{S.D}{\overline{X_1}} \times 100 = \frac{15.62}{44.6} \times 100 = 35.02$$

$\therefore$ Group G_2 is more variable.

Statistics Ex 32.7 Q9

CI	f	x	u=(x-A)/h	fu	u^2	fu^2
10-15	2	12.5	-2	-4	4	8
15-20	8	17.5	-1	-8	1	8
20-25	20	22.5	0	0	0	0
25-30	35	27.5	1	35	1	35
30-35	20	32.5	2	40	4	80
35-40	15	37.5	3	45	9	135
	100			108		266

Here, $N = 100, A = 22.5, \Sigma f_i u_i = 108, \Sigma f_i u_i^2 = 266$ and $h = 5$

$\therefore$ $$\text{Mean} = \overline{x} = A + h\left(\frac{1}{N}\Sigma f_i u_i\right)$$

$\Rightarrow$ $$\overline{x} = 22.5 + 5\left(\frac{108}{100}\right) = 27.90$$

$$\text{var}(x) = h^2\left[\frac{1}{N}\Sigma f_i u_i^2 - \left(\frac{1}{N}\Sigma f_i u_i\right)^2\right] = 25\left[\frac{266}{100} - \left(\frac{108}{100}\right)^2\right] = 37.34$$

$\therefore \quad S.D. = \sqrt{\text{var}(x)} = \sqrt{37.34} = 6.11$

$$\text{Coefficient of variation} = \frac{S.D}{\overline{X_1}} \times 100 = \frac{6.11}{27.90} \times 100 = 21.9$$

Statistics Ex 32.7 Q10

x	d=(x- Mean)	d²
35	-13	169
24	-24	576
52	4	16
53	5	25
56	8	64
58	10	100
52	4	16
50	2	4
51	3	9
49	1	1
480		980

$$\bar{x} = \frac{1}{n}\Sigma x_i = \frac{1}{10}[480] = 48$$

$$\text{var}(x) = \frac{1}{n}\left\{\Sigma\left(x_i - \bar{x}\right)^2\right\} = \frac{1}{10}\{980\} = 98$$

$$S.D(x) = \sqrt{\text{var}(x)} = \sqrt{98} = 9.9$$

$$\text{Coefficient of variation} = \frac{S.D}{\overline{X_1}} \times 100 = \frac{9.9}{48} \times 100 = 20.6$$

x	d=(x- Mean)	d²
35	-13	169
24	-24	576
52	4	16
53	5	25
56	8	64
58	10	100
52	4	16
50	2	4
51	3	9
49	1	1
480		980

$$\bar{x} = \frac{1}{n}\Sigma x_i = \frac{1}{10}[1050] = 105$$

$$\text{var}(x) = \frac{1}{n}\left\{\Sigma\left(x_i - \bar{x}\right)^2\right\} = \frac{1}{10}\{40\} = 4$$

$$S.D(x) = \sqrt{\text{var}(x)} = \sqrt{4} = 2$$

$$\text{Coefficient of variation for shares Y} = \frac{S.D}{\overline{X_1}} \times 100 = \frac{2}{105} \times 100 = 1.90$$

Since the coefficient of variation for shares Y is smaller than the coefficient of variation for shares X, they are more stable.