

CBSE Class-11 Mathematics
NCERT Solutions
Chapter - 15 Statistics
Exercise 15.3

1. From the data given below state which group is more variable, A or B:

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Group A	9	17	32	33	40	10	9
Group B	10	20	30	25	43	15	7

Ans. Group A

Marks	x_i	f_i	$u = \frac{x - 45}{10}$	fu	fu^2
10 - 20	15	9	-3	-27	81
20 - 30	25	17	-2	-34	68
30 - 40	35	32	-1	-32	32
40 - 50	45	33	0	0	0
50 - 60	55	40	1	40	40
60 - 70	65	10	2	20	40
70 - 80	75	9	3	27	81
		150		-6	342

$$\text{Mean } (\bar{x}) = A + \frac{\sum fu}{N} \times h$$

$$= 45 - \frac{6}{150} \times 10 = 45 - 0.4 = 44.6$$

$$\text{Standard deviation } (\sigma) = \frac{h}{N} \sqrt{N \sum fu^2 - (\sum fu)^2}$$

$$= \frac{10}{150} \sqrt{150 \times 342 - (-6)^2}$$

$$= \frac{1}{15} \sqrt{51300 - 36} = \frac{1}{15} \times 226.41 = 15.09$$

$$\text{C.V of Group A} = \frac{\sigma}{\bar{x}} \times 100 = \frac{15.09}{44.6} \times 100 = 33.83$$

Group B

Marks	x_i	f_i	$u = \frac{x - 45}{10}$	fu	fu^2
10 - 20	15	10	-3	-30	90
20 - 30	25	20	-2	-40	80
30 - 40	35	30	-1	-30	30
40 - 50	45	25	0	0	0
50 - 60	55	43	1	43	43
60 - 70	65	15	2	30	60
70 - 80	75	17	3	21	63
		150		-6	366

$$\text{Mean } (\bar{x}) = A + \frac{\sum fu}{N} \times h$$

$$= 45 - \frac{6}{150} \times 10 = 45 - 0.4 = 44.6$$

$$\text{Standard deviation } (\sigma) = \frac{h}{N} \sqrt{N \sum fu^2 - (\sum fu)^2}$$

$$= \frac{10}{150} \sqrt{150 \times 366 - (-6)^2}$$

$$= \frac{1}{15} \sqrt{54900 - 36}$$

$$= \frac{1}{15} \times 234.23 = 15.61$$

$$\text{C.V of Group B} = \frac{\sigma}{\bar{x}} \times 100 = \frac{15.61}{44.6} \times 100 = 35$$

C.V of Group B is greater than C.V of Group A, therefore Group B is more variable than Group A.

2. From the prices of shares X and Y below, find out which is more stable in value:

X	35	54	52	53	56	58	52	50	51	49
Y	108	107	105	105	106	107	104	103	104	101

Ans.

X	Y	$(X - \bar{x})$	$(Y - \bar{y})$	$(X - \bar{x})^2$	$(Y - \bar{y})^2$
35	108	-16	3	256	9
54	107	3	2	9	4
52	105	1	0	1	0
53	105	2	0	4	0
56	106	5	1	25	1
58	107	7	2	49	4
52	104	1	-1	1	1
50	103	-1	-2	1	4
51	104	0	-1	0	1
49	101	-2	-4	4	16
510	1050			350	40

$$\text{Mean } (\bar{x}) = \frac{510}{10} = 51$$

and

$$\text{Mean } (\bar{y}) = \frac{1050}{10} = 105$$

$$\sigma_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{\frac{350}{10}} = 5.92 \quad \text{and}$$

$$\sigma_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n}} = \sqrt{\frac{40}{10}} = 2$$

$$\text{C.V. of } x = \frac{5.92}{51} \times 100 = 11.61 \quad \text{and}$$

$$\text{C.V. of } y = \frac{2}{105} \times 100 = 1.9$$

\therefore C.V. of Y < C.V. of X

Therefore, prices of share Y are more stable than the share X.

3. An analysis of monthly wages paid to workers in two firms A and B, belonging to the same industry, gives the following results:

	Firm A	Firm B
No. of wage earners	586	648
Mean of monthly wages	Rs. 5253	Rs. 5253
Variance of the distribution of wages	100	121

(i) Which firm A or B larger amount as monthly wages?

(ii) Which firm A or B shows greater variability in individual wages?

Ans. (i) Firm A: Number of wages earners (n_1) = 586

Mean of monthly wages (\bar{x}_1) = Rs. 5253

\therefore Total money wages = 5253×586 = Rs. 3078258

Firm B: Number of wages earners (n_2) = 648

Mean of monthly wages (\bar{x}_1) = Rs. 5253

\therefore Total money wages = 5253×648 = Rs. 3403944

Firm B pays out larger amount as monthly wages than Firm A.

(ii) Since both the firms have same mean of monthly wages, so the firm with greater variance will have more variability in individual wages. Thus firm B will have more variability in individual wages.

(or C.V of Firm A = 0.19 and C.V of Firm B = 0.21, therefore Firm B shows greater variability in individual wages).

4. The following is the record of goals scored by team A in a football session:

No. of goals scored	0	1	2	3	4
No. of matches	1	9	7	5	3

For the team B, mean number of goals scored per match was 2 with a standard deviation 1.25 goals. Find which team may be considered more consistent?

Ans. Team A

x_i	f_i	$f_i x_i$	$f_i x_i^2$
0	1	0	0
1	9	9	9
2	7	14	28
3	5	15	45
4	3	12	48
	25	50	130

$$\text{Mean } (\bar{x}_A) = \frac{\sum f_i x_i}{N} = \frac{1}{25} \times 50 = 2$$

$$\text{Standard deviation } (\sigma_A) = \sqrt{\frac{\sum f_i x_i^2}{N} - \left(\frac{\sum f_i x_i}{N}\right)^2} = \sqrt{\frac{130}{25} - \left(\frac{50}{25}\right)^2}$$

$$= \sqrt{5.2 - 4} = \sqrt{1.2} = 1.095$$

$$\text{C.V. of Team A} = \frac{1.095}{2} \times 100 = 54.75 \quad \text{and} \quad \text{C.V. of Team B} = \frac{1.25}{2} \times 100 = 62.5$$

Here, C.V. of Team A < C.V. of team B

Therefore, team A is more consistent.

5. The sum and sum of squares corresponding to lengths x (in cm) and weight y (in gm) of 5- plant products are given below:

$$\sum_{i=1}^{50} x_i = 212, \quad \sum_{i=1}^{50} x_i^2 = 902.8, \quad \sum_{i=1}^{50} y_i = 261, \quad \sum_{i=1}^{50} y_i^2 = 1457.6$$

Which is more varying, the length or weight?

Ans. Given: $\sum_{i=1}^{50} x_i = 212, \quad \sum_{i=1}^{50} x_i^2 = 902.8, \quad \sum_{i=1}^{50} y_i = 261, \quad \sum_{i=1}^{50} y_i^2 = 1457.6$

$$\bar{x} = \frac{212}{50} = 4.24 \text{ cm}$$

$$\sigma_x^2 = \frac{1}{50} \times 902.8 - \left(\frac{212}{50} \right)^2$$

$$= 18.056 - 17.978 = 0.078$$

$$\sigma_x = \sqrt{0.078} = 0.28$$

Also $\bar{y} = \frac{261}{50} = 5.22 \text{ gm}$

$$\sigma_y^2 = \frac{1}{50} \times 1457.6 - \left(\frac{261}{50} \right)^2$$

$$= 29.152 - 27.248 = 1.904$$

$$\sigma_y = \sqrt{1.904} = 1.38$$

$$\text{C.V. of length} = \frac{0.28}{4.24} \times 100 = 6.6 \quad \text{and} \quad \text{C.V. of weight} = \frac{1.38}{5.22} \times 100 = 26.4$$

Here, C.V of weight > C.V. of length

Therefore, weight have more variability than length.