Exercise.5
Measures of dispersion – variance, standard deviation and coefficient of variation for grouped data

Standard deviation and Variance
Example 1

Discrete distribution

The frequency distributions of seed yield of 50 seasamum plants are given below. Find the standard deviation.

Seed yield in gms (x)	3	4	5	6	7
Frequency (f)	4	6	15	165	10

Solution

Seed yield in gms (x)	f	fx	fx²
3	4	12	36
4	6	24	96
5	15	75	375
6	15	90	540
7	10	70	490
Total	**50**	**271**	**1537**

Here N = 50

Standard deviation $S = \sqrt{\dfrac{\sum fx^2}{N} - \left(\dfrac{\sum fx}{N}\right)^2}$

$= \sqrt{\dfrac{1537}{50} - \left(\dfrac{271}{50}\right)^2}$

$= \sqrt{30.74 - 29.3764}$

1

$$= 1.1677 \text{ gms}$$

Variance $= \sqrt{1.1677} = 1.081$

Example 2

Continuous distribution

The Frequency distributions of seed yield of 50 seasamum plants are given below. Find the standard deviation.

Seed yield in gms (x)	2.5-35	3.5-4.5	4.5-5.5	5.5-6.5	6.5-7.5
No. of plants (f)	4	6	15	165	10

Solution

Seed yield in gms (x)	No. of Plants f	Mid x	$d=\dfrac{x-A}{C}$	df	$d^2 f$
2.5-3.5	4	3	-2	-8	16
3.5-4.5	6	4	-1	-6	6
4.5-5.5	15	5	0	0	0
5.5-6.5	15	6	1	15	15
6.5-7.5	10	7	2	20	40
Total	50	25	0	21	77

A=Assumed mean = 5

N=50, C=1

$$S = C \times \sqrt{\dfrac{\sum fd^2}{N} - \left(\dfrac{\sum fd}{N}\right)^2}$$

$$= 1 \times \sqrt{\frac{77}{50} - \left(\frac{21}{50}\right)^2}$$

$$= \sqrt{1.54 - 0.1764}$$

$$= \sqrt{1.3636} = 1.1677$$

Variance = $\sqrt{1.1677} = 1.081$

Coefficient of variation

Example 3

Consider the measurement on yield and plant height of a paddy variety. The mean and standard deviation for yield are 50 kg and 10 kg respectively. The mean and standard deviation for plant height are 55 am and 5 cm respectively.

Here the measurements for yield and plant height are in different units. Hence the variabilities can be compared only by using coefficient of variation.

For yield, $CV = \frac{10}{50} \times 100 = 20\%$

For plant height, $CV = \frac{5}{55} \times 100 = 9.1\%$

The yield is subject to more variation than the plant height.

Learning Exercise

1.	From the data given below, find which series is more consistent						
	Variable	10-20	20-30	30-40	40-50	50-60	60-70
	Series A	10	16	30	40	26	18
	Series B	22	18	32	34	18	16
2.	The yield of a crop sorghum from 31experimental plots are given below. Find the Range, Standard deviation, Variance, Coefficient of variation.						
		Grain Yield			No. of Plots		

130	3
135	4
140	6
145	6
146	3
148	5
149	2
150	1
157	1

3. The following table gives the protein intake of 400 families. Find the Range, Standard deviation, Variance, Coefficient of variation.

Protein intake / Consumption unit Per day in grams	No. of Families
15 - 25	30
25 – 35	40
35 – 45	100
45 – 55	110
55 – 65	80
65 –75	30
75 - 85	10