

EXERCISE 32.7

1. Two plants A and B of a factory show the following results about the number of workers and the wages paid to them

	Plant A	Plant B
No. of workers	5000	6000
Average monthly wages	₹2500	₹2500
The variance of distribution of wages	81	100

In which plant A or B is there greater variability in individual wages?

Solution:

Variation of the distribution of wages in plant A ($\sigma^2 = 81$)

So, Standard deviation of the distribution A ($\sigma = 9$)

Similarly, the Variation of the distribution of wages in plant B ($\sigma^2 = 100$)

So, Standard deviation of the distribution B ($\sigma = 10$)

And, Average monthly wages in both the plants is 2500,

Since, the plant with a greater value of SD will have more variability in salary.

\therefore Plant B has more variability in individual wages than plant A

2. The means and standard deviations of heights and weights of 50 students in a class are as follows:

	Weights	Heights
Mean	63.2 kg	63.2 inch
Standard deviation	5.6 kg	11.5 inch

Which shows more variability, heights or weights?

Solution:

Given: The mean and SD is given of 50 students.

Let us find which shows more variability, height and weight.

By using the formulas,

$$\text{Coefficient of variations} = \frac{\text{SD}}{\text{Mean}} \times 100$$

$$\text{Coefficient of variations in weights} = \frac{\text{SD}}{\text{Mean}} \times 100$$

$$\frac{5.6}{63.2} \times 100 = 8.86$$

$$\text{The coefficient of variations in weights} = \frac{\text{SD}}{\text{Mean}} \times 100$$

$$\frac{11.5}{63.2} \times 100 = 18.19$$

As results clearly show that coefficient of variations in heights is greater than coefficient of variations in weights.

∴ Heights will show more variability than weights

3. The coefficient of variation of two distribution are 60% and 70%, and their standard deviations are 21 and 16 respectively. What is their arithmetic means?

Solution:

Here, the Coefficient of variation for the first distribution is 60

And, Coefficient of variation for the first distribution is 70

SD (σ_1) = 21 and SD (σ_2) = 16

We know that, Coefficients of variation = $\frac{\text{SD}}{\text{Mean}} \times 100$

So,

$$\text{Mean, } \bar{X} = \frac{\text{SD}}{\text{CV}} \times 100$$

For first distribution

$$\begin{aligned} \bar{X} &= \frac{21}{60} \times 100 \\ &= 35 \end{aligned}$$

For the second distribution

$$\begin{aligned} \bar{X} &= \frac{16}{70} \times 100 \\ &= 22.86 \end{aligned}$$

∴ Means are 35 and 22.86

4. Calculate coefficient of variation from the following data:

Income (in ₹):	1000-1700	1700-2400	2400-3100	3100-3800	3800-4500	4500-5200
No. of families:	12	18	20	25	35	10

Solution:

Let us find the standard deviation of the frequency:

Class	F_i	x_i	$u_i = \frac{x_i - \text{mean}}{700}$	$f_i u_i$	$f_i u_i^2$
1000-1700	12	1350	-2	-24	48
1700-2400	18	2050	-1	-18	18
2400-3100	20	2750	0	0	0
3100-3800	25	3450	1	25	25
3800-4500	35	4150	2	70	140
4500-5200	10	4850	3	30	90
	$\sum f_i = 120$			$\sum u_i f_i = 83$	$\sum u_i^2 f_i = 321$

Now,

$$N = 120, \sum u_i^2 f_i = 321$$

$$\text{Mean, } \bar{X} = A + h \left(\frac{\sum u_i f_i}{N} \right)$$

$$\begin{aligned} \bar{X} &= 2750 + 700 \left(\frac{83}{120} \right) \\ &= 3234.17 \end{aligned}$$

$$\text{Var}(X) = h^2 \left[\frac{1}{N} \sum_{i=1}^n f_i u_i^2 - \left(\frac{1}{N} \sum_{i=1}^n u_i f_i \right)^2 \right]$$

$$\text{Var}(X) = 490000 \left[\left(\frac{321}{120} \right) - \left(\frac{83}{120} \right)^2 \right]$$

$$\text{Variance} = 1076332.64$$

$$\begin{aligned} \text{Standard Deviation, } \sigma &= \sqrt{1076332.64} \\ &= 1037.47 \end{aligned}$$

$$\text{Coefficients of variation} = \frac{1037.46}{3234.17} \times 100$$

$$= 32.08$$

∴ The coefficient variation is 32.08

5. An analysis of the weekly 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
Average weekly wages	₹52.5	₹47.5
The variance of the distribution of wages	100	121

(i) Which firm A or B pays out the larger amount as weekly wages?

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

Solution:

$$(i) \text{ Average weekly wages} = \frac{\text{Total weekly wages}}{\text{No. of workers}}$$

$$\text{Total weekly wages} = (\text{Average weekly wages}) \times (\text{No. of workers})$$

$$\text{Total weekly wages of Firm A} = 52.5 \times 586 = \text{Rs } 30765$$

$$\text{Total weekly wages of Firm B} = 47.5 \times 648 = \text{Rs } 30780$$

Firm B pays a larger amount as Firm A

(ii) Here, SD (firm A) = 10 and SD (Firm B) = 11

$$\text{Coefficient variance (Firm A)} = \frac{10}{52.5} \times 100$$

$$= 19.04$$

$$\text{Coefficient variance (Firm B)} = \frac{11}{47.5} \times 100$$

$$= 23.15$$

∴ Coefficient variance of firm B is greater than that of firm A, Firm B has greater variability in individual wages.

6. The following are some particulars of the distribution of weights of boys and girls in a class:

	Boys	Girls
Number	100	50
Mean weight	60 kg	45 kg
Variance	9	4

Which of the distributions is more variable?

Solution:

Given: SD (Boys) is 3 and SD (girls) = 2

$$\text{Coefficient variability} = \frac{\text{SD}}{\text{Mean}} \times 100$$

$$\begin{aligned}\text{Coefficient variance (Boys)} &= \frac{3}{60} \times 100 \\ &= 5\end{aligned}$$

$$\begin{aligned}\text{Coefficient variance (Girls)} &= \frac{2}{45} \times 100 \\ &= 4.4\end{aligned}$$

∴ Coefficient variance of Boys is greater than Coefficient variance of girls, and then the distribution of weights of boys is more variable than that of girls.

