EXERCISE 32.7 PAGE NO: 32.47

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 (σ^2 =18)
So, Standard deviation of the distribution A (σ – 9)

Similarly, the Variation of the distribution of wages in plant B (σ^2 =100)
So, Standard deviation of the distribution B (σ – 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.
∴ 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

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

So,

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

For first distribution

$$\bar{X} = \frac{21}{60} \times 100$$
$$= 35$$

For the second distribution

$$\bar{X} = \frac{16}{70} \times 100$$
$$= 22.86$$

∴ 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_iu_i	$f_iu_i^2$
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,

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

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

$$\bar{X} = 2750 + 700\left(\frac{83}{120}\right)$$

$$= 3234.17$$

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

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

Variance = 1076332.64

Standard Deviation, $\sigma = \sqrt{1076332.64}$

$= 1037.47$

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

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

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

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

∴ 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.