Exercise 06 – November 25-December 4, 2025

1. Let's consider a scenario where you're trying to predict the exam score based on the number of hours studied, but the sample data has more variability due to other factors like individual learning styles, distractions, or even exam difficulty.

Hours of Study (X)	Exam Score (Y)
1	52
2	59
3	62
4	64
5	72
6	80
7	74
8	83
9	91
10	89

   a. Find the regression equation (Y' = bX + A).
   b. After that, predict the exam score for someone who studied for 7 hours. Compare the results with the data in the table, explaining why the predictions are not the same.
   c. Then, predict the exam score for someone who studied for 11 hours.

Solution:

Step 1: Write down the data

X (Hours)	Y (Score)	X^2	XY
1	52	1	52
2	59	4	118
3	62	9	186
4	64	16	256
5	72	25	360
6	80	36	480
7	74	49	518
8	83	64	664
9	91	81	819
10	89	100	890

Step 2: Compute totals

$$\sum Y = 726$$
$$\sum X^2 = 385$$
$$\sum XY = 4343$$
$$n = 10$$

Step 3: Formula for regression coefficients

$$b = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$
$$A = \frac{\sum Y - b\sum X}{n}$$

Step 4: Calculate slope (b)

$$b = \frac{10(4343) - (55)(726)}{10(385) - (55)^2}$$
$$b = \frac{43430 - 39930}{3850 - 3025}$$
$$b = \frac{3500}{825} = 4.24$$

Step 5: Calculate intercept (A)

$$A = \frac{726 - (4.24)(55)}{10}$$
$$A = \frac{726 - 233.2}{10}$$
$$A = \frac{492.8}{10} = 49.28$$

Step 6: Regression equation

$$Y' = 4.24X + 49.28$$

Step 7: Predict score for 7 hours

$$Y' = 4.24(7) + 49.28$$
$$Y' = 29.68 + 49.28 = 78.96$$

Predicted score ≈ 79
Actual score in table = 74

Why prediction ≠ actual value?

- Regression gives an average trend, not exact values
- Individual factors affect performance:
  - Learning style
  - Distractions
  - Exam difficulty
- The regression line minimizes total error, not individual error

Step 8: Predict score for 11 hours

$$Y' = 4.24(11) + 49.28$$
$$Y' = 46.64 + 49.28 = 95.92$$

Predicted score ≈ 96

2. You are given the following sample data showing the height (in inches) and weight (in pounds) of 5 people:

Height (X)	Weight (Y)
60	140
62	145
64	160
66	170
68	155

a. Find the regression equation (Y' = bX + A).
b. After that, predict the weight for someone who is 70 inches tall.

Solution:

Step 1: Write down the data

Height (X)	Weight (Y)	X^2	XY
60	140	3600	8400
62	145	3844	8990
64	160	4096	10240
66	170	4356	11220
68	155	4624	10540

Step 2: Compute totals

$$\sum X = 320$$
$$\sum Y = 770$$
$$\sum X^2 = 20520$$
$$\sum XY = 49390$$
$$n = 5$$

Step 3: Calculate slope (b)

$$b = \frac{5(49390) - (320)(770)}{5(20520) - (320)^2}$$
$$b = \frac{246950 - 246400}{102600 - 102400}$$
$$b = \frac{550}{200} = 2.75$$

Step 4: Calculate intercept (A)

$$A = \frac{770 - (2.75)(320)}{5}$$
$$A = \frac{770 - 880}{5}$$

$$A = \frac{-110}{5} = -22$$

Step 5: Regression equation

$$Y' = 2.75X - 22$$

Step 6: Predict weight for 70 inches

$$Y' = 2.75(70) - 22$$
$$Y' = 192.5 - 22 = 170.5$$

Predicted weight ≈ 171 pounds