EXERCISE - 3

Implement linear repression

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A) Implementing linear repression for the following

a)

x	y
1	1
2	4
3	9
4	16
5	25

$$\bar{x} = \frac{\Sigma x}{n} = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{5} = \frac{15}{5} = 3$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{y_1 + y_2 + y_3 + y_4 + y_5}{5} = \frac{55}{5} = 11$$

$$\boxed{\bar{x} = 3 \; ; \; \bar{y} = 11}$$

$$\beta_0 = \bar{y} - \beta_1 \bar{x}$$

$$\beta_1 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$$

$$\beta_1 = \frac{(x_1 - \bar{x})(y_1 - \bar{y}) + (x_2 - \bar{x})(y_2 - \bar{y}) + (x_3 - \bar{x})(y_3 - \bar{y}) + (x_4 - \bar{x})(y_4 - \bar{y}) + (x_5 - \bar{x})(y_5 - \bar{y})}{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2 + (x_4 - \bar{x})^2 + (x_5 - \bar{x})^2}$$

$$\beta_1 = \frac{(1-3)(1-11) + (2-3)(4-11) + (3-3)(9-11) + (4-3)(16-11) + (5-3)(25-11)}{(1-3)^2 + (2-3)^2 + (3-3)^2 + (4-3)^2 + (5-3)^2}$$

$$\beta_1 = \frac{20 + 7 + 0 + 5 + 28}{4 + 1 + 0 + 1 + 4} = \frac{60}{10} \Rightarrow \boxed{\beta_1 = 6}$$

$$\beta_0 = \bar{y} - \beta_1 \bar{x}$$

$$\beta_0 = 11 - 6(3) \qquad \rightarrow \boxed{y = -7 + 6x}$$

$$\beta_0 = 11 - 18$$

$$\boxed{\beta_0 = -7}$$

b)

x	y
5	10
7	20
10	30
12	40
20	50

$$\bar{x} = \frac{\Sigma x}{n} = \frac{54}{5} = 10.8$$

$$\bar{y} = \frac{\Sigma y}{n} = \frac{150}{5} = 30$$

$$\boxed{\bar{x} = 10.8, \ \bar{y} = 30}$$

$$\beta_0 = \bar{y} - \beta_1 \bar{x}$$

$$\beta_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$$\beta_1 = \frac{(5-10.8)(10-30) + (7-10.8)(20-30) + (10-10.8)(30-30) + (12-10.8)(40-30) + (20-10.8)(50-30)}{(5.8)^2 + (-3.8)^2 + (10-10.8)^2 + (12-10.8)^2 + (9.2)^2}$$

$$\beta_1 = \frac{(-5.8)(-20) + (-3.8)(-10) + (1.2)(10) + (9.2)(20)}{33.64 + 14.44 + 0.64 + 1.44 + 84.64}$$

$$\beta_1 = \frac{116 + 38 + 12 + 184}{134.8} = \frac{350}{134.8}$$

$$\boxed{\beta_1 = 2.5964}$$

$$\beta_0 = 30 - (2.5964)\,10.8$$

$$= 30 - 28.04112$$

$$\boxed{\beta_0 = 1.95888}$$

$$\boxed{y = 1.95888 + (2.5964)x}$$