

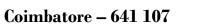


## TOPIC 2.9- Linear Regression

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Regression Regression is a mathematical measure of the average relationship between two or more variables interms of the original limits of the da The line of regression of Y on X is give  $y-\bar{y} = \gamma \frac{\sigma_y}{\sigma_z} (x-\bar{x})$ by where r is the correlation coefficient. The line of regression of X on Y is gn.  $\chi - \bar{\chi} = \gamma \cdot \frac{\sigma_{\chi}}{\sigma} (y - \bar{y})$ by Angle between two lines of regression The angle ce between the two lines of regression is given by  $\tan \alpha = \frac{1-\gamma^2}{\gamma} \left( \frac{\sigma_x \sigma_y}{\sigma_y^2 + \sigma_y^2} \right)$ 







Note  

$$1 \cdot If \gamma = 0$$
, we get  $tom a = \infty$   
 $\boxed{0 = \frac{\pi}{2}}$   
 $\therefore$  when  $\gamma = 0$ , the lines of regression are  
perpendicular to each other.

Regression coefficients  
Regression coefficient of 
$$\gamma$$
 on  $\chi$   
 $\gamma = \frac{\sigma_{\gamma}}{\sigma_{\chi}} = b_{\gamma\chi} \rightarrow 0$   
Regression coefficient of  $\chi$  on  $\gamma$   
 $\gamma = \frac{\sigma_{\chi}}{\sigma_{\chi}} = b_{\chi\chi} \rightarrow 2$   
From (1) and (2), we get  
correlation coefficient  $\gamma = \pm \sqrt{b_{\chi\chi} b_{\gamma\chi}}$   
Note  
The regression coefficients  $b_{\chi\chi}$  and  $b_{\chi\chi}$  can  
be obtained by the following formula  
 $b_{\gamma\chi} = \frac{\sum (\chi - \bar{\chi})(y - \bar{y})}{\sum (\chi - \bar{\chi})^2}$ 

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$$b_{XY} = \frac{\sum (x-\bar{x}) (y-\bar{y})}{\sum (y-\bar{y})^2}$$
D) From the following data, find  
(i) the two regression equations  
(ii) the two regression equations  
(iii) the coefficient of correlation between the marks  
in Economics and Statistics  
(iii) The most likely marks in statistics when marks  
in Economics are 30  
Harks in 25 28 35 32 31 36 29 38 34 32  
Economics  $43$  46 49 41 36 32 31 30 33  $\overline{3}$   
Here  $\overline{x} = \frac{\sum x}{n} = \frac{320}{10} = 32$   
 $\overline{y} = \frac{\sum y}{n} = \frac{380}{10} = -\frac{32}{10}$   
Coefficient regression of y on x is  
 $b_{yx} = \frac{\sum (x + \overline{x}) (y - \overline{y})}{\sum (x - \overline{x})^2} = -\frac{93}{140}$ 

= - 0.6643





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| x   | У   | x - <del>x</del><br>x - 32 | У - <del>У</del><br>У - 38 | $(x-\bar{x})^{2}$ | (y-ŷ) <sup>2</sup> | (x - x)(y - y) |
|-----|-----|----------------------------|----------------------------|-------------------|--------------------|----------------|
| 25  | 43  | -7                         | 5                          | 49                | 25                 | - 35           |
| 28  | 46  | -4                         | 8                          | 16                | 64                 | - 32           |
| 35  | 49  | 3                          | 11                         | 9                 | 121                | 33             |
| 32  | 41  | 0                          | з                          | 0                 | 9                  | 0              |
| 31  | 36  | -1                         | - 2                        | L.                | 4                  |                |
| 36  | 32  | 4                          | - 6                        | 16                | 36                 | 2<br>- 12      |
| 29  | 31  | - 3                        |                            | 9                 | 49                 | 21             |
| 38  | 30  | 6.                         | - 8                        | 36                | 4                  |                |
| 34  | 33  | 2                          | -5                         | 4                 | 64                 | - 48           |
| 32  | 39  | 0                          | 1                          | 0                 | 25                 | - 10           |
| 320 | 380 | 0                          | 0                          | 140               | 398                | - 93           |

$$b_{xy} = \frac{\sum (x - \overline{x})(y - \overline{y})}{\sum (y - \overline{y})^2} = -\frac{93}{398}$$
  
= - 0.2337  
(i) The equation of the line of regression of x on  
 $x - \overline{x} = b_{xy}(y - \overline{y})$   
 $x - 32 = -0.2337(y - 38)$ 



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$$x = -0.2337 y + 40.8806$$

The equation of the line of regression of Y on  

$$y-\overline{y} = b_{y_X}(x-\overline{x})$$
  
 $y-38 = -0.6643(x-32)$   
 $y = -0.6643x + 59.2576$ 

(ii) Coefficient of correlation  

$$\gamma = \pm \sqrt{b_{xy} b_{yx}}$$
  
 $= \pm \sqrt{(-0.2337)(-0.6643)}$   
 $\gamma = -0.394$ 

(iii) To find the most likely marks in statistics (Y) when marks in Economics (X) are 30 Y = -0.66432 + 59.2576Put x = 30, Y = 39.3286Y = -9.3286





(2) The equation of two regression lines are 8x-10y+66 = 0 and 40x-18y-214 = 0. Find the mean values of x & y and the correlation coefficient between x and y.

Since both the line of regression passing through (I, J), we get

$$8\overline{x} - 10\overline{y} = -66 \longrightarrow 1$$

$$40\overline{x} - 18\overline{y} = 214 \longrightarrow 2$$

$$1 \times 5 \implies 40\overline{x} - 50\overline{y} = -330$$

$$40\overline{x} - 18\overline{y} = -214$$

$$-32\overline{y} = -544$$

$$\overline{y} = 17$$

$$8\bar{x} - 170 = -66$$
  
 $8\bar{x} = 170 - 66$   
 $8\bar{x} = 104$   
 $\bar{x} = 13$