




# SIMPLE LINEAR REGRESSION Part 4

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➤ **Example:** For the variables  $x$  and  $y$ , the regression equations are given as

➤  $7x - 3y - 18 = 0$  and


➤  $4x - y - 11 = 0$

➤ (i) Find the arithmetic means of  $x$  and  $y$ .

➤ (ii) Identify the regression equation of  $y$  on  $x$ .

➤ (iii) Compute the correlation coefficient between  $x$  and  $y$ .

➤ (iv) Given the variance of  $x$  is 9, find the SD of  $y$ .

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- ▶ i) Since the two lines of regression intersect at the point  $(\bar{x}, \bar{y})$ , replacing  $x$  and  $y$  by  $\bar{x}$  and  $\bar{y}$  respectively in the given regression equations, we get
  - ▶  $7\bar{x} - 3\bar{y} - 18 = 0$  and
  - ▶  $4\bar{x} - \bar{y} - 11 = 0$
  - ▶ Solving these two equations, we get  $\bar{x} = 3$  and  $\bar{y} = 1$   
Thus the arithmetic means of  $x$  and  $y$  are given by 3 and 1 respectively.
  - ▶ (ii) Let us assume that  $7x - 3y - 18 = 0$  represents the regression line of  $y$  on  $x$  and  $4x - y - 11 = 0$  represents the regression line of  $x$  on  $y$ .
  - ▶ Now  $7x - 3y - 18 = 0$  (Y on X)
  - ▶  $3y = -18 + 7x$
  - ▶  $Y = -6 + 7x/3$
  
  - ▶ Now this equation is in the form of  $Y = a + bX$
  
  - ▶ Therefore slope =  $b = b_{yx} = 7/3$



- ▶ Again  $4x - y - 11 = 0$  (X on Y)

- ▶  $4x = 11 + y$

- ▶  $x = 11/4 + y/4$

- ▶ Now this equation is in the form of  $X = c + dY$

- ▶ Slope =  $d = b_{xy} = 1/4$

- ▶ Thus  $r^2 = b_{yx} \times b_{xy}$

- ▶  $= 7/3 \times 1/4$

- ▶  $= 7/12 \leq 1$

- ▶ Since  $r^2 \leq 1$ , our assumptions are correct. Thus,  $7x - 3y - 18 = 0$  truly represents the regression line of y on x.



➤ (iii) Since  $r^2 = 7/12$

➤  $r = \sqrt{7}/12$

➤  $= 0.7638$

➤ (iv)  $b_{yx} = r \times \frac{S_y}{S_x}$

➤  $S_x$

➤  $\frac{7}{3} = \frac{0.7638 \times S_y}{3}$

➤  $3$

➤  $S_y = \frac{7}{0.7638}$

➤  $= 9.1647$




► **PRACTISE QUESTIONS**

► **Q:** Marks of 8 students in Mathematics and statistics are given as:

Mathematics:	80	75	76	69	70	85	72	68
Statistics:	85	65	72	68	67	88	80	70

► Find the regression lines. When marks of a student in Mathematics are 90, what are his most likely marks in statistics?

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- Q : The following data relate to the mean and SD of the prices of two shares in a stock Exchange:

Share	Company A	Company B
Mean (in Rs)	44	58
SD (in Rs)	5.60	6.30

- Coefficient of correlation between the share prices = 0.48

Find the most likely price of share A corresponding to a price of Rs. 60 of share B and also the most likely price of share B for a price of Rs. 50 of share A.