

5. The data for marks in Physics and History obtained by 10 students are given below:

Physics	15	12	8	8	7	7	7	6	5	3
History	10	25	17	11	13	17	20	13	9	15

Using this data:

- find the line of regression in which Physics is taken as a independent variable.
- A candidate had scored 10 marks in Physics but was absent from the history test. Estimate his probable score for the latter test. (ISC 2008)

Solution:

Let the marks obtained in Physics and History be x and y respectively. Let assumed mean of marks of Physics be = 8 and assumed mean of marks of History be = 15.

x	y	u $= x - 8$	v $= y - 15$	$uv =$ $(x - 8)(y - 15)$	$u^2 =$ $(x - 8)^2$
15	10	7	-5	-35	49
12	25	4	10	40	16
8	17	0	2	0	0
8	11	0	-4	0	0
7	13	-1	-2	2	1
7	17	-1	2	-2	1
7	20	-1	5	-5	1
6	13	-2	-2	4	4
5	9	-3	-6	18	9
3	15	-5	0	0	25
$\sum x$ $= 78$	$\sum y$ $= 150$	$\sum u$ $= -2$	$\sum v$ $= 0$	$\sum uv$ $= 22$	$\sum u^2$ $= 106$

$$\therefore \bar{x} = \frac{\sum x}{n} = \frac{78}{10} = 7.8 \quad \text{and} \quad \bar{y} = \frac{\sum y}{n} = \frac{150}{10} = 15$$

- Since Physics is taken as a independent variable, we have to find out the regression line of y on x .

$$b_{yx} = \frac{\sum uv - \frac{1}{n} \sum u \sum v}{\sum u^2 - \frac{1}{n} (\sum u)^2} = \frac{22 - \frac{1}{10}(-2)(0)}{106 - \frac{1}{10}(-2)^2} = \frac{22}{105.6} = \frac{5}{24}$$

The regression line of y on x is

$$y - \bar{y} = b_{yx} (x - \bar{x})$$

$$\Rightarrow y - 15 = \frac{5}{24} (x - 7.8)$$

$$\Rightarrow 24y - 360 = 5x - 39$$

$\Rightarrow 24y = 5x + 321$ which is the equation of regression line taking Physics as independent variable.

- When marks of Physics is 10 i.e., $x = 10$,

$$y = \frac{5}{24} x + \frac{321}{24} = \frac{5}{24} \times 10 + \frac{321}{24} = 15.5 \quad (\text{approximately})$$

\therefore The required probable score of History = **15.5 marks.**