

Pinky Rani

Assistant Professor (Guest Faculty)

Department of Economics

Maharaja College

Veer Kunwar Singh University, Ara

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Topic- Coefficient of Correlation by Direct method

Q. Find Out Karl Pearson's Coefficient of Correlation by direct method:

Series X: 17 18 19 19 20 20 21 21 22 23

Series Y: 12 14 16 11 15 19 22 16 15 20

X - Series			Y - Series			
X-Series	$(x-20)$ dx	dx^2	Y-Series	$(y-16)$ dy	dy^2	$dx dy$
17	$17-20=-3$	$(-3)^2=9$	12	$12-16=-4$	$(-4)^2=16$	$-4 \times -3=12$
18	$18-20=-2$	$(-2)^2=4$	14	$14-16=-2$	$(-2)^2=4$	$-2 \times -2=4$
19	$19-20=-1$	$(-1)^2=1$	16	$16-16=0$	$(0)^2=0$	$-1 \times 0=0$
19	$19-20=-1$	$(-1)^2=1$	11	$11-16=-5$	$(-5)^2=25$	$-1 \times -5=5$
20	$20-20=0$	$(0)^2=0$	15	$15-16=-1$	$(-1)^2=1$	$0 \times -1=0$
20	$20-20=0$	$(0)^2=0$	19	$19-16=3$	$(3)^2=9$	$0 \times 3=0$
21	$21-20=1$	$(1)^2=1$	22	$22-16=6$	$(6)^2=36$	$1 \times 6=6$
21	$21-20=1$	$(1)^2=1$	16	$16-16=0$	$(0)^2=0$	$1 \times 0=0$
22	$22-20=2$	$(2)^2=4$	15	$15-16=-1$	$(-1)^2=1$	$2 \times -1=-2$
23	$23-20=3$	$(3)^2=9$	20	$20-16=4$	$(4)^2=16$	$3 \times 4=12$
$\Sigma x=200$	$\Sigma dx=0$	$\Sigma dx^2=30$	$\Sigma y=160$	$\Sigma dy=0$	$\Sigma dy^2=108$	$\Sigma dx dy=37$

$\bar{X} = \frac{\Sigma x}{N} = \frac{200}{10} = 20$

$\sigma_x = \sqrt{\frac{\Sigma dx^2}{N}} = \sqrt{\frac{30}{10}} = \sqrt{3} = 1.73$

$\bar{Y} = \frac{\Sigma y}{N} = \frac{160}{10} = 16$

$$\delta y = \sqrt{\frac{\sum dy^2}{N}} = \sqrt{\frac{108}{10}} = \sqrt{10.8} = 3.28$$

$$r = \frac{\sum dx dy}{N \cdot \delta x \cdot \delta y} = \frac{3.7}{10 \times 1.73 \times 3.28} = \frac{3.7}{56.744} = 0.652$$

Moderate degree
of correlation exist.