Devasy Patel    Ralno: 20BCE057

## ASSIGNMENT - 1

**Q1**

| $x$ | 1 | 2 | 3 | 4 | 5 |
|-----|---|---|---|---|---|
| $y$ | 2 | 5 | 3 | 8 | 7 |

**A1**

| $x$ | $y$ | $xy$ | $x^2$ | $y^2$ |
|-----|-----|------|-------|-------|
| 1 | 2 | 2 | 1 | 4 |
| 2 | 5 | 10 | 4 | 25 |
| 3 | 3 | 9 | 9 | 9 |
| 4 | 8 | 32 | 16 | 64 |
| 5 | 7 | 35 | 25 | 49 |
| 15 | 25 | 88 | 55 | 251 |

$$\bar{x} = \frac{\Sigma x}{n} = \frac{15}{5} = 3 \quad, \quad \bar{y} = \frac{\Sigma y}{n} = \frac{25}{5} = 5$$

→ Regression $y$ on $x$:

$$b_{yx} = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{5 \times 88 - 15 \times 25}{5(55) - (15)^2}$$

$$= \frac{440 - 375}{275 - 225}$$

∴ $\boxed{byx = 1.3}$

∴ $y - \bar{y} = b_{yx}(x - \bar{x})$

∠ $y - 5 = 1.3(x - 3)$

∴ $10y = 13x + 11$    [Regression line $y$ on $x$]

→ **Regression line $x$ on $y$ :-**

$$b_{xy} = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma y^2 - (\Sigma y)^2} = \frac{5(88) - 15 \times 25}{5 \times 151 - (25)^2} = \frac{440 - 375}{755 - 625}$$

$$\therefore \underline{b_{xy} = 0.5}$$

$$\therefore x - \bar{x} = b_{xy}(y - \bar{y}) :$$

$$\therefore x - 3 = 0.5(y - 5)$$

$$\therefore \underline{2x = y + 1} \qquad [\text{Regression line } x \text{ on } y]$$

$$\therefore \text{Correlation coeff} : r = \sqrt{b_{xy} \cdot b_{yx}} = \sqrt{1.3 \times 0.5}$$

$$r = \sqrt{0.65}$$

$$\therefore r = \pm 0.8062$$

as both $b_{xy}$ & $b_{yx}$ are +ve $\therefore$ $r = + 0.8062$

**Q2**

| Paper I | 80 | 45 | 55 | 56 | 58 | 60 | 65 | 68 | 70 | 75 | 85 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Paper II | 81 | 56 | 50 | 48 | 60 | 62 | 64 | 65 | 70 | 74 | 90 |

let $P-1 = x$ & $P-11 = y$

| $x$ | $y$ | $xy$ | $x^2$ | $y^2$ |
|---|---|---|---|---|
| 80 | 81 | 6480 | 6400 | 6561 |
| 45 | 56 | 2520 | 2025 | 3136 |
| 55 | 50 | 2750 | 3025 | 2500 |
| 56 | 48 | 2688 | 3136 | 2304 |
| 58 | 60 | 3480 | 3364 | 3600 |
| 60 | 62 | 3720 | 3600 | 3844 |
| 65 | 64 | 4160 | 4225 | 4096 |
| 68 | 65 | 4420 | 4624 | 4225 |
| 70 | 70 | 4900 | 4900 | 4900 |
| 75 | 74 | 5550 | 5625 | 5476 |
| 85 | 90 | 7650 | 7225 | 8100 |
| 717 | 720 | 48318 | 48149 | 48742 |

Teacher's Signature:

$\Sigma x = 717$          $\Sigma y = 720$

$\Sigma x^2 = 48149$          $\Sigma y^2 = 48742$

$\therefore \bar{x} = \Sigma x/n = 717/11 = 65.18$

$\bar{y} = \Sigma y/n = 720/11 = 65.45$

$\Rightarrow$ Regression line for x:-

$$byx = \frac{n\Sigma xy - \Sigma x.\Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{11 \times (48318) - (717)(720)}{11 \times (48149) - (717)^2}$$

$\therefore byx = 0.98$

$$\& bxy = \frac{n\Sigma xy - \Sigma x.\Sigma y}{n\Sigma y^2 - (\Sigma y)^2} = \frac{11 \times 48318 - 717 \times 720}{\frac{529634}{11 \times 48742} - (720)^2}$$

$\therefore bxy = 0.86$

$\Rightarrow$ Regression for x:-

$y - \bar{y} = byx(x - \bar{x})$

$y - 65.45 = 0.98(x - 65.18)$

$\therefore y - 65.45 = 0.98x - 63.8764$

$\therefore 100y = 98x + 157.4$

$\Rightarrow$ Regression x on y:-

$x - \bar{x} = bxy(y - \bar{y})$

$\therefore x - 65.18 = 0.86(y - 65.45)$

$\therefore x = 0.86 y + 8.893$

$\therefore 100x = 86y + 889.3$

$\Rightarrow$ coefficient of correlation :-

$r = \sqrt{byx.bxy} = \sqrt{0.86 \times 0.98} = \sqrt{0.8428} = 0.918$

Q3  $b_{xy} = 0.8$   $b_{yx} = 0.2$

$r = \sqrt{r_x \cdot r_y} = \sqrt{0.8 \times 0.2} = 0.4$

$\therefore \boxed{r = 0.4}$  correlation coefficient

Q4  Var $(x) = 9$

regression    $8x - 10y + 66 = 0$ — ① $\times 5$
              $40x - 18y - 214 = 0$

for $(\bar{x} \& \bar{y})$

$40x - 50y + 330 = 0$
$40x - 18y - 214 = 0$
$-$      $+$      $+$
$\overline{\qquad\qquad\qquad}$
$y = 17$

$\therefore x = 13$

$\therefore \bar{x}, \bar{y} = (13, 17)$

c) coefficient of correlation :-

$x = 18y + \dfrac{214}{40}$   &   $y = \dfrac{8}{10}x + \dfrac{66}{10}$
$\qquad\dfrac{}{40}$

$\therefore b_{xy} = 0.45$   &   $b_{yx} = 0.8$

$\therefore r^2 = 0.45 \times 0.8$   $\therefore r = 0.6$

[1,2,4]:7    7-1   6
$\tau^{-4} = 1$
$\frac{7}{12}\frac{x}{3e}$
6-2-4
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**6)** $\sigma y \div$      $bxy = \gamma \dfrac{\sigma x}{\sigma y}$      $\therefore 0.45 = \dfrac{0.6 \times 3}{\sigma y}$

$$\therefore \boxed{\sigma y = 4}$$

**Q5**  $20x - 9y - 107 = 0$      $\sigma_y^2 = 9$
$4x - 5y + 33 = 0$      $\sigma x = 3$

**q)** Mean values of $x \& y$

$$20x - 9y - 107 = 0$$
$$20x - 25y + 165 = 0$$
$$\underset{+}{-} \qquad \underset{-}{+}$$
$$\overline{\qquad\qquad\qquad}$$

$16y = 272$   $\therefore y = 16$
$8x = 11.75$

$\therefore \bar{x} = 11.75 \ \& \ \bar{y} = 16$

**6)** $\sigma y = ?$

$x = \dfrac{9}{20}y + \dfrac{107}{20}$   ∴ $bxy = 0.45$   $\& \ byx = 0.8$

$y = 0.8x + 6.6$ _____   $\therefore \gamma^2 = 0.45 \times 0.8$

$\therefore \gamma = 0.6$

$$\therefore \boxed{\sigma y = 4}$$

**A6.** $8x + 2y = 26$

$6x + y = 31$

a) Mean values

$6x + y = 31$

$6x + 4y = 52$

$- \quad - \quad -$

$+3y = +21$

$\therefore \boxed{y = 7}$

$\therefore \bar{x} = 4, \bar{y} = 7$

**b)** $8x + 2y = 26$

$\therefore y = \dfrac{-8}{2}x + \dfrac{26}{2}$

$byx = -1.5$

$6x + y = 31$

$x = \dfrac{-1}{6}y + \dfrac{31}{6}$

$\therefore bxy = -0.1667$

$r = \sqrt{-1.5 \times (-0.167)} \quad \therefore r = \sqrt{0.25} \quad = \pm 0.5$

$r = -0.5 \qquad$ as $byx$ & $bxy$ are $-ve$

**A7.** Pearson's coeff of correlation

| X | Y | dx | dy | dx² | dy² | dx.dy |
|---|---|---|---|---|---|---|
| 160 | 192 | -5 | 33 | 25 | 1089 | -165 |
| 164 | 280 | -3 | 21 | 9 | 441 | -63 |
| 172 | 260 | 1 | 1 | 1 | 1 | 1 |
| 182 | 234 | 6 | -25 | 36 | 625 | -150 |
| 166 | 266 | -2 | 7 | 4 | 49 | -14 |
| 170 | 254 | 0 | 5 | 0 | 25 | 0 |
| 178 | 230 | 4 | -29 | 16 | 841 | -116 |
| | | 1 | 3 | 91 | 3071 | -507 |

$\therefore \bar{x} = \dfrac{1192}{7} = 170.28 \qquad \bar{y} = \dfrac{1816}{7} = 259.42$

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→ Assumed mean = 170     6=284

$$dx = \frac{x-170}{2}, \quad dy = \frac{y-289}{1}$$

∴ $byx = \dfrac{n\Sigma\, dxdy - \Sigma dx \times \Sigma dy}{n\Sigma dx^2 - (\Sigma dx)^2} = \dfrac{7(-507) - 1\times 3}{7\times 91 - 1^2}$

$$= \frac{6 - 3552}{636} = -5.58$$

⊅ Regression y on x :—

$byy = \dfrac{-3552}{7(307)-9} = \dfrac{-3552}{21488}$

∴ $y - \bar{y} = byx(x - \bar{x})$

$bxy = -0.1653$

∴ $y - 259.42 = -5.58(x - 170.28)$

∴ $y = -5.58x + 1210.45$

⊅ Regression x on y :—

$$x - \bar{x} = bxy(y - \bar{y}) \qquad \therefore x - 170.28 = -0.1653(y - 259.42)$$

$$x = -0.165y + 213.169$$

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18.  $PV^\gamma = C$   $\therefore$  $V = \left(\dfrac{C}{P}\right)^{1/\gamma}$   $c = C^{1/\gamma} \times P^{-1/\gamma}$

$\therefore$ $\log V = \dfrac{1}{\gamma} \log c - \dfrac{1}{\gamma} \log(P)$

$\parallel$   $\parallel$   $\parallel$  $\parallel$   $\parallel$           $B = -1/\gamma$

$\therefore$ $Y = A + BX$

| P | V | X | Y | XY | $X^2$ |
|---|---|---|---|---|---|
| 0.5 | 1.6 | -0.301 | 0.2041 | -0.061 | 0.09062 |
| 1 | 1 | 0 | 0 | 0 | 0 |
| 1.5 | 0.75 | 0.1760 | -0.1249 | -0.0219 | 0.031 |
| 2 | 0.62 | 0.3010 | -0.2076 | -0.0624 | 0.090 |
| 2.5 | 0.52 | 0.3979 | -0.2839 | -0.113 | 0.1583 |
| 3 | 0.46 | 0.4771 | -0.3372 | -0.1608 | 0.2276 |
| | | 1.051 | -0.7495 | -0.255 | 0.59825 |

$\therefore$ $\Sigma y = nA + B\Sigma x$

$\Sigma xy = A\Sigma x + B\Sigma x^2$

$\therefore$  $-0.7495 = 6A + B \times 1.051$

$-0.255 = 1.051A + 0.59825B$

$A = 0.09124$

$B = -0.592241$      $\gamma = -1/B = 1/0.592241$

$\therefore \gamma = 1.688$

$\log C = \gamma A$

$= 1.688 \times (0.09124)$

$\therefore \log C = 0.15240$

$\therefore C = 1.4256$    $\therefore PV^{1.688} = 1.4256$

$\therefore$ At Pressure $= 3.5$

$$V^{1.6888} = \frac{1.4256}{3.5} = 0.4073$$

$$\therefore V = (0.4073)^{\frac{1}{1.688}} = 0.5873$$