Probablity & Stats
Assignment - 11

Qs) 15)

a) $\Sigma x^2 = 925000$; $\Sigma x = 850$

$\Sigma y^2 = 372717$; $\Sigma y = 1737$

$\Sigma xy = 1825600$

$S_{xx} = 852750$

$S_{yy} = 71000.1$

$S_{xy} = 34915$

$\beta = 0.040944$

$\alpha = 170.219$

$\therefore$ Eqn $= \alpha + \beta x$

$= 170.219 + 0.040944x$

b) $\because \beta = 0.040944$

i.e β is close to 0

Hence it is not significant.

25) 1) $\Sigma x^2 = 12666.58$; $\Sigma x = 385.2$

$\Sigma y^2 = 119026.9$; $\Sigma y = 1162.5$

$\Sigma xy = 38191.41$

$S_{xx} = 301.66$

$S_{xy} = 875.16$

$S_{yy} = 6409.7125$

Date :

$\beta = 2.9011$

$\alpha = 3.7496$

$\therefore$ Eqn $= 3.7496 + 2.9011x$

ii) $\sigma^2 = 387.0744$

$\because \hat{\beta} \sim N(\beta, \sigma^2/S_{xx})$

$\therefore$ 95% C.I

$= \beta \pm t_{2.5\%, 12} \left(\frac{\sigma}{\sqrt{S_{xx}}}\right)$

$= 2.9011 \pm \frac{(0.6955)(22.2861)}{(2.228)} (1.132)$

$= (-46.752, 52.554)$

$= (0.379, 5.423)$

iii) $Y \sim N(\hat{\alpha} + \beta x, \frac{1}{n} + \left(\frac{(x_0 - \bar{x})^2}{S_{xx}}\right)\sigma^2)$

i.e $Y \sim N(119.7936,$

C.I $= y_0 \pm t_{\alpha/2, n-2} \sqrt{\left[\frac{1}{n} + \frac{(X_0 - \bar{X})^2}{S_{xx}}\right]\sigma^2}$

$= 119.7936 \pm 2.228 (8.9534) 22.143$

$= (97.6504$ to $141.9306)$

Q3) i) In city A & city B it takes longer hours while travelling in peak. while in city C and D time diff is similar where as in city D we might reach early.

Page :
Date :

(a) $\Sigma x = 39$ $\quad \Sigma y = 562$ $\quad \Sigma xy = 285$

$\Sigma x^2 = 207$ $\quad \Sigma y^2 = 40508$

$S_{xx} = 54.9$

$S_{yy} = 8923.6$

$S_{xy} = 661.2$

i) $r = \dfrac{S_{xy}}{\sqrt{S_{xx} \cdot S_{yy}}} = 0.944662$

ii) $\beta = 12.0437$

$\alpha = -9.22957$

$\therefore$ Eqn $= -9.22957 + 12.0437x$

iii) $SS_{TOT} = SS_{REG} + SS_{RES}$

$SS_{REG} = \dfrac{S_{xy}^2}{S_{xx}}$ $\quad SS_{RES} = S_{yy} - \dfrac{S_{xy}^2}{S_{xx}}$

$= 7963.30$ $\quad = -14,41,805.776$

960.295

$\therefore SS_{TOT} = 8923.595$

iv) $R^2 = \dfrac{S_{xy}^2}{S_{xx} \cdot S_{yy}} = 0.8928$

Page :
Date :

As R^2 is between 0 to 1, it is significant

7) $\Sigma x = 174.13$; $\Sigma x^2 = 7545.9$

$\Sigma y = 197.84$; $\Sigma y^2 = 4747.45$

$S_{xx} = 4789.4221$; $S_{yy} = 1189.2076$; $S_{xy} = 2176.84$

i) $\beta = 2.20017$

$\alpha = -16.8432$

$\therefore \hat{y} = -16.8432 + 2.20017x$

ii) $H_0 : \beta = 0$

$H_1 : \beta \neq 1$

$\hat{\sigma}^2 = 199.8121$

$t_{cal} = \dfrac{\hat{\beta} - \beta}{\sigma^2 / \sqrt{S_{xx}}} = 10.77176$

$t_{tab} = 2.20017$

$\because t_{cal} > t_{tab}$

$\therefore$ Reject H_0

$\therefore$ There is a linear relationship between x and y

iii) $\therefore r = 0.912128$

Date :

9) $\Sigma x = 45$ $\Sigma x^2 = 277.5$

$\Sigma y = 644$ $\Sigma y^2 = 43956$ $\Sigma xy = 2602$

$S_{xx} = 75$: $S_{yy} = 2482.4$: $S_{xy} = -296$

i) looking at the plot, I can see a negative correlation between x and y

ii) $r = -0.686$

∴ There is a strong negative co-relation

iii) $\tanh^{-1} r \sim N(\tanh^{-1} \rho, 1/n-3)$

$H_0 : \rho = 0$

$H_1 : \rho < 0$

$$\frac{\tanh^{-1} r - \tanh^{-1} \rho}{\sqrt{\frac{1}{n-3}}} = Z_{cal}$$

$\therefore Z_{cal} = -2.22338$

$Z_{tab} = Z_{2.5} = 1.96$

$Z_{0.5} = 2.5758$

at 5% LOS Reject H_0

at 1% LOS do not reject H_0

∴ There is negative co-relation at 5% LOS

∴ There is no co-relation at 1% LOS