Probability & Stats - 2 Assignment - 2

1) $\Sigma x = 850$ $\Sigma x^2 = 92500$

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

$\Sigma xy = 182560$

$$S_{xx} = 92500 - 10 \times \left(\frac{850}{10}\right)^2$$

$$= 20250$$

$$S_{yy} = 71000$$

$$S_{xy} = 34915$$

$$\hat{\beta} = \frac{34915}{20250} = 1.724$$

$$\hat{\alpha} = 173.7 - 1.724 \times 85$$

$$= 27.16$$

(a) $\hat{y} = \hat{\alpha} + \hat{\beta} x$

$= 27.16 + 1.724x$. Ans.

2. $S_{xx} = 301.66$ $S_{yy} = 6409.712$

$S_{xy} = 875.16$.

$$\hat{\beta} = \frac{875.16}{301.66} = 2.901$$

$\hat{\alpha} = 3.74818$

$\hat{y} = 3.748 + 2.901x$ Ans.

ii) 95% CI = (

$\hat{\beta} = 2.901$

$\hat{\alpha} = 3.74818$

$\hat{\sigma}^2 = \frac{1}{12-2}\left(6409.712 - \frac{875.16^2}{301.66}\right)$

$= \frac{1}{10}(3870.744)$

$= 387.0744$

$\frac{\hat{\beta} - \beta}{\sqrt{\hat{\sigma}^2 / S_{xx}}} \sim t_{n-2}$

$95\%\ CI = \left(\hat{\beta} - t_{n-2,\frac{\alpha}{2}} \sqrt{\frac{\hat{\sigma}^2}{S_{xx}}},\ \hat{\beta} + t_{n-2,\frac{\alpha}{2}} \sqrt{\frac{\hat{\sigma}^2}{S_{xx}}}\right)$

$= \left(2.901 - 2.228 \times \sqrt{\frac{387.07}{301.66}},\ 2.901 + 2.228 \sqrt{\frac{387.07}{301.66}}\right)$

$= (0.3772, 5.4248)$ Ans.

iii) when Dell share price is $40.

$\hat{y}_0 = 3.74818 + 2.901 \times 40$

$= 119.518$ Ans.

3) ANOVA

Source	Df	Sum of squares.	MSS
Reg	1	SSreg	SSreg/1
Res.	n-2	SSres.	SSres/(n-2)
		SS_{Tot}.	

ii) $SS_{Tot} = S_{yy} = 1495 - \left(\frac{103^2}{28}\right)$

$= 1116.11$

$S_{Reg} = \frac{1}{7}\left(6265 - \frac{103^2}{4}\right) = 516.11$

$SS_{res} = S_{Tot} - SS_{Reg} = 1116.11 - 516.11$

$= 600.00$

ANOVA

	df	SS	MSS
	1	516.11	516.11
	26	600	23.077
	27		

$F = \frac{516.11}{23.077} = 22.36$

Q4) $SS_{Tot} = 69930.06$

$SS_{reg} = 2235.69$

$SS_{res} = 47604.37$

ANOVA

	df	SS	MSS
	4	2235.69	558.42
	126	47604.37	1700.156
	30	69930.06	

$F = 3.28$ $F_{4,30} = 2.714$ at 5%. LOS.

$\therefore$ Reject H_0.

Q4) ii) Contingency table

Oi.

	Salary.			
	45	20	6	5
Papers	7	20	9	6
	5	8	15	20

Ei.

27.4	23.8	14.4	11.06
15.4	12.7	8.19	6.09
14.13	12.6	7.8	5.8

$$\chi^2_6 = \sum \frac{(O_i - E_i)^2}{E_i}$$

$$= 49.919$$

$$df = (3-1)(4-1) = 6.$$

$\chi^2_{6,5\%} = 12.59$ (χ^2_{test} is one sided)

∴ Reject H_0.

Q5)

Source	df	SS	MSS
Reg.	3	21.153	7.051
Res.	8	1.236	0.155
Total	11	22.38	

$F_{3,8,5\%} = 7.951$

$\therefore$ we reject H_0.

6) i) $S_{xx} = 207 - 10 \times \left(\frac{39}{10}\right)^2$

$= 54.9$

$S_{yy} = 40508 - 10 \times \left(\frac{562}{10}\right)^2$

$= 8923.6$

$S_{xy} = 2853 - 10 \times \frac{39}{10} \times \frac{562}{10}$

$= 661.2$

$r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}} = \frac{661.2}{\sqrt{54.9 \times 8923.6}} = 0.9446$

$$\hat{\beta} = \frac{S_{xy}}{S_{xx}} = \frac{661.2}{54.9} = 12.043$$

$$\hat{\alpha} = 56.2 - 12.043 \times 3.9$$

$$= 9.2323$$

$\hat{y} = 9.2323 + 12.043x$ Ans.

iii) $SS_{tot} = S_{yy} = 8923.6$

$$SS_{reg} = \frac{S_{xy}^2}{S_{xx}} = \frac{661.2^2}{54.9}$$

$$= 7963.304.$$

$$SS_{res} = SS_{tot} - SS_{reg}$$

$$= 960.295$$

iv) $$R^2 = \frac{SS_{reg}}{SS_{tot}} = \frac{7963.304}{8923.6}$$

$= 0.8923$ Ans

7). $$S_{xx} = 7545.90 - 11 \times \left(\frac{174.13}{11}\right)^2$$

$$= 4789.4221$$

$$S_{yy} = 4747.45 - 11 \times \left(\frac{197.84}{11}\right)^2$$

$$= 1189.207$$

$S_{xy} = 2176.84$

$\hat{\beta} = 0.45451$ $\hat{y} = 10.79056 + 0.45451x$

$\hat{\alpha} = 10.79056$

ii) $H_0: \beta = 0$ $\quad H_1: \beta \neq 0$.

$$\frac{\hat{\beta} - \beta}{\sqrt{\hat{\sigma}^2 / S_{xx}}} \sim t_{n-2}$$

$$\hat{\sigma}^2 = \frac{1}{9}(199.81)$$

$$\hat{\sigma}^2 = 22.201$$

$$\frac{0.4545 - 0}{\sqrt{\frac{22.201}{4789.4221}}} \sim t_9.$$

2.262

$$= 6.6755$$

Greater than 2.262 upper limit of $t_{9, 2.5\%}$.

Sufficient evidence to reject H_0.

iii) $R^2 = \frac{S_{xy}^2}{S_{xx} S_{yy}} = 0.8319$

$= 83.19\%$.

iv) According to me, the fit of the model is not good, because the points do not form a linear line and has 2 outliers as well.

a) $S_{xx} = 277.5 - 10 \times \left(\frac{45}{10}\right)^2 = 75$

$S_{yy} = 73956 - 10 \times \left(\frac{644}{10}\right)^2 = 2482.4$

$S_{xy} = 2602 - 10 \times \frac{45}{10} \times \frac{644}{10} = -296.$

$R^2 = \frac{(-296)^2}{75 \times 2482.4} = 0.4705$

$= 47.05\%$. Ans.

The two variables are not strongly correlated.

iv) $\hat{\beta} = \frac{-296}{75} = -3.94$

$\hat{\alpha} = \frac{644}{10} - (-3.94) \times \frac{45}{10}$

$= 82.13$

$\hat{y}_0 = 82.13 - 3.94 x_0$ marks.

v) $R^2 = 0.4705 = 47.05\%$.

vi) $x_0 = 5.5$

$\hat{y}_0 = 82.13 - 3.94 \times 5.5$

$= 60.46$ marks.

10) $S_{xx} = 0.0042$ $S_{yy} = 0.00126$

$S_{xy} = 0.0022$

$SS_{tot} = 0.00126$ $SS_{reg} = \frac{S_{xy}^2}{S_{xx}} = 0.00115$

$SS_{res} = 0.00011$

ANOVA TABLE.

source	df	SS	MSS
Reg	1	0.00115	0.00115
Res	1	0.00011	0.00011
Tot	2	0.00126	

$F_{1,1;5\%} = 161.4$

Do not reject H_0.