Assignment

Q.1. A] let say patient has a selfesteem score of 76 what would be prediction depression score.
B] Suppose patient has a depression score of 11 what would be predicted self esteem score.

Depression (x) selfesteem

Depression	10	12	19	4	25	15	21	7
selfesteem	104	100	98	150	75	105	82	133

$\Rightarrow$

Depression × selfesteem	Depression^2	selfesteem^2
1040	100	10816
1200	144	10000
1862	361	9604
600	16	22500
1875	625	5625
1722	441	6724
931	49	17689
1575	225	11025
10805	1961	93983

$n = 8$

$$r = \frac{n \Sigma xy - \Sigma x \Sigma y}{\sqrt{[n \Sigma x^2 - (\Sigma x)^2][n \Sigma y^2 - (\Sigma y)^2]}}$$

$$= \frac{8(10805) - 113 \times 847}{\sqrt{[8(1961) - (113)^2][8(93983) - (847)^2]}}$$

$$= \frac{86440 - 95711}{\sqrt{(15688 - 12769)(751864 - 717409)}}$$

$$= \frac{-9271}{} = -0.924$$

Mean : $(\bar{X}) = \frac{10+12+19+4+25+15+21+7}{8} = 14.125$

$(\bar{Y}) = \frac{104+100+98+150+75+105+82+133}{8}$

$= 105.87$

SD : $x = \sqrt{\frac{\Sigma(x-\bar{x})^2}{(n-1)}} = 7.219$

for $y = \sqrt{\frac{\Sigma(y-\bar{y})^2}{n-1}} = 24.804$

$x' = \left[\frac{r_{xy} \times \sigma_x}{\sigma_y}\right](y-\bar{y}) + \bar{x}$

$= \left[\frac{-0.924 \times 7.219}{24.804}\right](76 - 105.87) + 14.125$

$= 22.159$

$y' = \left[\frac{r'_{xy} \times \sigma_y}{\sigma_x}\right](x-\bar{x})\Big] + \bar{y}$

$= \left[\frac{-0.924 \times 24.804}{7.219}\right](11 - 14.125)\Big] + 105.87$

$= \left[(-3.17480) - (3.125)\right] + 105.87$

$y' = 115.797$

Assignment : 2

Q.1 Estimate the yield when rainfall is 29cm and the rainfall when the yield is 600kg

	yield in kg (y)	Rainfall in cm (x)
mean	508	26.7
SD	36.8	4.6
r	0.52	

find the a] Regression line y on x

$y - \bar{y} = b_{yx}(x - \bar{x})$ $\qquad b_{yx} = r \times \frac{\sigma_y}{\sigma_x}$

b] Regression line x on y

$x - \bar{x} = b_{xy}(y - \bar{y})$ $\qquad b_{xy} = r \times \frac{\sigma_x}{\sigma_y}$

$\Longrightarrow$ Regression line y on x

$$y - 508 = 0.52 \times \frac{36.8}{4.6}(29 - 26.7)$$

$$y - 508 = \frac{104}{25}(2.3)$$

$$y = 9.568 + 508$$

$$y = 517.568 \text{ kg}$$

$$y - 508 = 0.52 \times \frac{36.8}{4.6}(x - 26.7)$$

$$\boxed{y = 4.16x + 396.92}$$

$$y = 517.568 \text{ kg}$$

Regression line x on y

$$x - 4.6 = 0.52 \times \frac{4.6}{36.8}(y - 508)$$

$$\boxed{x = 0.065y - 6.346}$$

$$x = 32.654 \text{ kg}$$

Q.2 Estimate age of husband when the age
estimate age of wife when the husband age

(x) Age of husband	(y) Age of wife	xy	x^2	y^2
25	18	450	625	
22	15	330	484	
28	20	560	784	
26	17	442	676	
35	22	770	1225	
20	14	280		
22	16	352		
40	21	840		
20	15	300		
18	14	252		
256	172	4576	7002	

$$r = \frac{10 \times (4576) - (256 \times 172)}{\sqrt{[10 \times (7002) - (256)^2]\,(10 \times 3036 - (172)^2)}}$$

$$= \frac{1728}{\sqrt{(70020 - 65536)(30360 - 29584)}}$$

$$= 0.9263$$

Mean : $(\overline{X}) = 25.6$

$(\overline{Y}) = 17.2$

SD $X = 7.058$

SD $Y = 2.936$

$$x' = \left[\frac{r_{xy} \times \sigma x}{\sigma y}\right] (y - \overline{y}) + \overline{x}$$

$$= \left[\frac{0.9263 \times 7.058}{2.936}\right] (19 - 17.2) + 25.6$$

$$x' = [29.359]$$

$$y' = \left[\frac{r_{xy} \times \sigma y}{\sigma x}\right] (x - \overline{x}) + \overline{y}$$

$$= \left[\frac{0.9263 \times 2.936}{7.058}\right] [30 - 25.6] + 17.2$$

$$y' = 18.895$$

Assignment 6

For a given dataset calulate the regress sum and developed a multiple linear regression model

x_1	x_2	y	x_1^2	x_2^2	$x_1 y$	$x_2 y$	$x_1 x_2$
3	8	-3.7	9	64	-11.1	-29.6	24
4	5	3.5	16	25	14	17.5	20
5	7	2.5	25	49	12.5	17.5	35
6	3	11.5	36	9	69	34.5	18
2	1	5.7	4	1	11.4	5.7	2
20	24	19.5	~~400~~	~~576~~	~~390~~	~~468~~	~~480~~
			~~490~~	~~729~~	~~48~~		

$\Sigma x_1 = 20$

$\Sigma x_2 = 24$

$\Sigma y = 19.5$

$\Sigma x_1^2 = 90$

$\Sigma x_2^2 = 148$

$\Sigma x_1 y = 95.8$

$\Sigma x_2 y = 45.6$

$\Sigma x_1 x_2 = 99$

$$\Sigma x_1^2 = \left[90 - \left((20)^2 / 5 \right) \right] = 10$$

$$\Sigma x_2^2 = \left[148 - \left((24)^2 / 5 \right) \right] = 32.8$$

$$\Sigma x_1 y = \left[95.8 - \left((20 \times 19.5) \right) / 5 \right] = 17.8$$

$$\Sigma x_2 y = \left[45.6 - \left((24 \times 19.5) / 5 \right) \right) = -48$$

$$\Sigma x_1 x_2 = \left[99 - \left((20 \times 24) / 5 \right) \right] = 3$$

b_0, b_1, b_2

$$b_1 = \frac{32.8 \times 17.8 - (3 \times -48)}{[10 \times 32.8] - (3)^2} = 2.2816$$

$$b_2 = \frac{(10 \times -48) - (3 \times 17.8)}{(10 \times 32.8) - (3)^2} = -1.6721$$

$$b_0 = \bar{Y} - b_1 \bar{X_1} - b_2 \bar{X_2}$$
$$= 3.9 - (2.2816)(4) - (-1.6721)(4.8)$$
$$b_0 = 2.79968$$

$$\hat{y} = b_0 + b_1 * x_1 + b_2 * x_2$$
$$\hat{y} = 2.7996 + 2.2816 x_1 - 1.6721 x_2$$

Assignment 8

Q.1

	Y	x_1	x_2	x_1^2	x_2^2	$x_2 Y$	$x_1 x_2$
	2.45	84	15	7056	225	36.75	1260
	1.77	66	8	4356	64	13.76	528
	2.37	68	46	4624	2116	103.02	3128
	2.23	65	24	4725	576	53.52	1560
	1.92	69	12	4761	144	23.04	828
	1.99	72	25	5184	625	49.75	1800
	1.99	63	45	3869	2025	89.55	2835
	2.35	56	72	3136	5184	169.2	4032
Total	17.02	543	247	37311	10959	544.	15971

$\Sigma x_1^2 = 37311 - (43)^2/8$

$= 454.875$

$\Sigma x_1^2 = 454.875$

$\Sigma x_2^2 = 10959 - (247)^2/8$

$\Sigma x_2^2 = 3332.875$

$\Sigma x_1 y = 1158.16 - \dfrac{543 \times 17.02}{8}$

$\Sigma x_1 y = 2.9275$

$\Sigma x_2 y = 544.59 - \dfrac{247 \times 17.02}{8}$

$\Sigma x_2 y = 19.0975$

$\Sigma x_1 x_2 = \dfrac{15971 - 593 \times 247}{8} = -794.125$

$b_1 = \dfrac{(333.2875 \times 2.9275) - (-794.125) \times 19.0975)}{454.875 \times 3332.875 - (-794.125)^2}$

$b_1 = 0.0281$

$b_2 = 0.0184$

$b_0 = -0.1026$

$\hat{y} = -0.1026 + 0.0281\, x_1 + 0.0124\, x_2$

$\hat{y}$	$(y-\hat{y})^2$	$(y-\bar{y})^2$	$(\hat{y}-\bar{y})^2$
2.3838	0.0044	0.109	0.0457
1.7912	0.0051	0.1661	0.1131
2.3186	0.0076	0.0588	0.0565
1.9615	0.0721	0.0105	0.0276
1.9251	0.0002	0.043	0.0909
2.1706	0.0326	0.0189	0.0018
2.1657	0.0308	0.0189	0.0015
2.3038	0.0021	0.0495	0.0311
Total 17.02	0.1497	0.4697	0.3182

$$R^2 = \frac{0.3182}{0.4697} = 0.6774$$

$h_0 \Rightarrow \partial = b_0 \; b_1 \; \& \; b_2 = 0$

$h_a \Rightarrow b_1 \; \& \; b_2 \neq 0$

$df_1 = k = 2$ $\qquad df_2 = n-k-1 = 8-2-1 = 5$

$$MSR = \frac{0.3182}{2} = 0.1591$$

$$MSE = \frac{0.1497}{5} = 0.0299$$

$$F \text{ test} = \frac{MSR}{MSE} = \frac{0.1591}{0.0299} = 5.3139$$

$\therefore$ for 2,5 df and $\alpha = 0.05$ F test value is 5.7861

$\therefore$ F test cal < F test table

h_0 is accepted

Multiple Linear Regression

	y	x_1	x_2
	140	60	22
	155	62	25
	159	67	24
	179	70	20
	192	71	15
	200	72	14
	212	75	14
	215	78	11
Mean	181.5	69.375	18.125
Sum	1452	555	145

	x_1^2	x_2^2	x_1y	x_2y	x_1x_2
	3600	484	8400	3080	1320
	3844	625	9610	3875	1550
	4489	576	10653	3816	1608
	4900	400	12530	3580	1400
	5041	225	13632	2880	1065
	5184	196	14400	2800	1008
	5625	196	15900	2968	1050
	6084	121	16770	2365	858
Sum	38767	2823	101895	25364	9859
Reg Sums	263.875	194.875	1162.5	-953.5	-200.375

Step 3: Calculate b_0, b_1, and b_2

- The formula to calculate b_1 is: $[(\Sigma x_2^2)(\Sigma x_1 y) - (\Sigma x_1 x_2)(\Sigma x_2 y)] / [(\Sigma x_1^2)(\Sigma x_2^2) - (\Sigma x_1 x_2)^2]$
- Thus, $\mathbf{b_1} = [(194.875)(1162.5) - (-200.375)(-953.5)] / [(263.875)(194.875) - (-200.375)^2] = \mathbf{3.148}$
- The formula to calculate b_2 is: $[(\Sigma x_1^2)(\Sigma x_2 y) - (\Sigma x_1 x_2)(\Sigma x_1 y)] / [(\Sigma x_1^2)(\Sigma x_2^2) - (\Sigma x_1 x_2)^2]$
- Thus, $\mathbf{b_2} = [(263.875)(-953.5) - (-200.375)(1152.5)] / [(263.875)(194.875) - (-200.375)^2] = \mathbf{-1.656}$

The formula to calculate b_0 is: $y - b_1X_1 - b_2X_2$

- Thus, $\mathbf{b_0} = 181.5 - 3.148(69.375) - (-1.656)(18.125) = \mathbf{-6.867}$

Step 5: Place b_0, b_1, and b_2 in the estimated linear regression equation.

- The estimated linear regression equation is: $\hat{y} = b_0 + b_1{*}x_1 + b_2{*}x_2$

$$\hat{y} = -6.867 + 3.148x_1 - 1.656x_2$$