Program

```
x<-c (4,4.4,3.9,4,4.2,4.4,5,4.8,3.9);x
y<-c (5.3,4.3,4.1,4.1,4.4,5.5,4.2,3.8,5.4,4.6);y
cor(x,y)
```

Output

r=-0.100242

PRACTICAL SHEET - 05 (Fitting of curve)

1. Calculate the correlation coefficient

Marks A	4.0	4.4	3.9	4.0	4.2	4.4	5.0	4.8	4.6	3.9
Marks B	5.3	4.3	4.1	4.1	4.4	5.5	4.2	3.8	5.4	4.6

Solution>

correlation coefficient, $r = \dfrac{cov(x,y)}{\sqrt{V(x)}\sqrt{V(y)}}$

x_i	x_i^2	y_i	y_i^2	x_iy_i
4	16	5.3	28.09	21.2
4.4	19.36	4.3	18.49	18.92
3.9	15.21	4.1	16.81	15.99
4.0	16	4.1	16.81	16.4
4.2	17.64	4.4	19.36	18.48
4.4	19.36	5.5	30.25	24.2
5.0	25	4.2	17.64	21
4.8	23.04	3.8	14.44	18.24
4.6	21.16	5.4	29.16	24.84
3.9	15.21	4.6	21.16	17.94
43.2	187.98	45.7	212.21	197.21

$E(x) = \Sigma x/n$

$= 4.32$

$E(y) = \Sigma y_i/n$

$= 4.57$

$E(x^2) = \frac{1}{n}\Sigma x_i^2$

$= 18.798$

$E(y^2) = \frac{1}{n}\Sigma y_i^2$

$= 21.221$

$var(X) = E(X^2) - [E(X)]^2$
$= 0.1356$

$var(Y) = E(Y^2) - [E(Y)]^2$
$= 0.3361$

$cov(X,Y) = E(XY) - E(X)E(Y)$
$= -0.0214$

correlation coefficient, $r = \dfrac{-0.0214}{\sqrt{0.1356 \times 0.3361}}$

$= -0.1002$

Program

```
x <- c(3,5,6,7,10,11);x
y <- c(8,12,11,14,16,17);y
lm(y~x)
lm(x~y)
```

output

Call:

lm(formula = y ~ x)

coefficient:

(intercept)	x
5.543	1.067

Call:

lm(formula = x ~ y)

coefficient:

(intercept)	y
-4.375	0.875

2. fit a regression line of Y on X & X on Y for the following

length(x)	3	5	6	7	10	11
weight(y)	8	12	11	14	16	17

Solution >

x_i	y_i	x_i^2	y_i	x_iy_i
3	8	9	64	24
5	12	25	144	60
6	11	36	121	66
7	14	49	196	98
10	16	100	256	160
11	17	121	289	187
42	78	340	1070	595

$\bar{x} = E(x) = 7$

$\bar{y} = E(y) = 13$

$E(x^2) = 56.667$

$E(y^2) = 56.667$

$E(xy) = \Sigma x_iy_i/n$

$= 99.164$

$cov(X,Y) = E(XY) - E(X)E(Y)$

$= 8.17$

$V(X) = E(X^2) - (E(X))^2$

$= 7.667$

$V(Y) = E(Y^2) - [E(Y)]^2$

$= 9.333$

Regression line of Y on X

$$\Rightarrow (y-\bar{y}) = b_{yx}(x-\bar{x})$$

$$(y-\bar{y}) = \frac{cov(x,y)}{V(x)}(x-\bar{x})$$

$$y = 1.065x + 5.543$$

Regression line of X on Y

$$\Rightarrow (x-\bar{x}) = b_{yx}(y-\bar{y})$$

$$x-\bar{x} = \frac{cov(x,y)}{V(Y)}(y-q)$$

$$x = 0.875y - 4.376$$

3. Find spearman's rank correlation for the following

Rank given by 1st judge	1	6	5	8	3	2	4	7
Rank given by 2nd judge	3	5	7	4	6	3	2	1

x	y	Rank x	Rank y	d	d2
1	3	1	3.5	-2.5	6.25
6	5	6	6	0	0
5	7	5	8	-3	9
8	4	8	5	3	9
3	6	3	7	-4	16
2	3	2	3.5	-1.5	2.25
4	2	4	2	2	4
7	1	7	1	6	36

Spearman's rank correlation, $\rho = 1 - \frac{6\sum d^2}{n^2(n^2-1)}$

$$\rho = 1 - \frac{6 \times 825}{8(64-1)}$$

$$= 1 - 495/504$$

$$= \underline{0.01964}$$

4. Find the equation of the form $y = ab^x$ to the data

x	2	3	4	5	6
y	144	172.8	207.4	248	298.6

Solution > $y = ab^x$

Taking log on both sides

$\log y = \log a + x \log b$.

let $Y = \log y$, $A = \log a$, $B = \log b$.

$Y = A + Bx$

x_i	y_i	$Y = \log y_i$	x_i^2	$x_i Y_i$
2	144	2.1584	4	4.3168
3	172.8	2.2375	9	6.7125
4	207.4	2.3168	16	9.2675
5	248	2.3945	25	11.9725
6	298.~~6~~	2.4751	36	14.8506
20	1070.8	11.5823	90	47.1196

$$\sum_{i=1}^{5} x_i Y_i = B \sum_{i=1}^{5} x_i^2 + A \sum_{i=1}^{5} x_i$$

$$\Rightarrow 47.1196 = 90B + 20A \quad \text{—— (1)}$$

$$\sum_{i=1}^{5} Y_i = 5A + B \sum_{i=1}^{5} x_i$$

$\Rightarrow 11.5823 = 20B + 5A$ — (2)

Solving (1) & (2)

$A = 2$, $B = 0.079$

$\therefore Y = 2 + 0.079x$

Then $\log a = 2$

$a = \text{Antilog}(2)$
$= 100$

$\log b = 0.079$

$b = \text{Antilog}(0.079)$
$= 1.2$

Required equation

$y = (100)(1.2)^x$

Program

```
x <- c(5,10,15,20,25,30);x
y <- c(7,17,27,37,47,57);y
lm(y~x) # Y on X
```

Output

call:

lm(formula = y~x)

coefficient:

intercept	x
-3	2

5. Fit a straight line of the form $y = ax+b$.

x	5	10	15	20	25	30
y	7	17	27	37	47	57

solution>

x_i	$u_i = (x-15)/5$	u_i^2	y_i	$v_i = (y_i-27)/10$	u_iv_i
5	-2	4	7	-2	4
10	-1	1	17	-1	1
15	0	0	27	0	0
20	1	1	37	1	1
25	2	4	47	2	4
30	3	9	57	3	9
	3	19		3	19

let $u = \frac{x-15}{5}$ and $v = \frac{y-27}{10}$

Then the equation becomes $v = a'u + b' \longrightarrow (a)$

$$\sum_{i=1}^{6} u_iv_i = a'\sum_{i=1}^{6} u_i^2 + b'\sum_{i=1}^{6} u_i$$

$$\Rightarrow 19 = 19a' + 3b' \longrightarrow (1)$$

$$\sum_{i=1}^{6} v_i = a'\sum_{i=1}^{6} u_i + nb'$$

$$\Rightarrow 3 = 3a' + 6b' \text{ — } (2)$$

Solving (1) & (2)

$a' = 1$, $b' = 0$

Substituting in (a)

$v = u$

ie, $\frac{y-27}{\cancel{10}\,2} = \frac{x-15}{\cancel{5}}$

$y = 2x - 3$ with $a = 2$ and $b = -3$ is the required equation