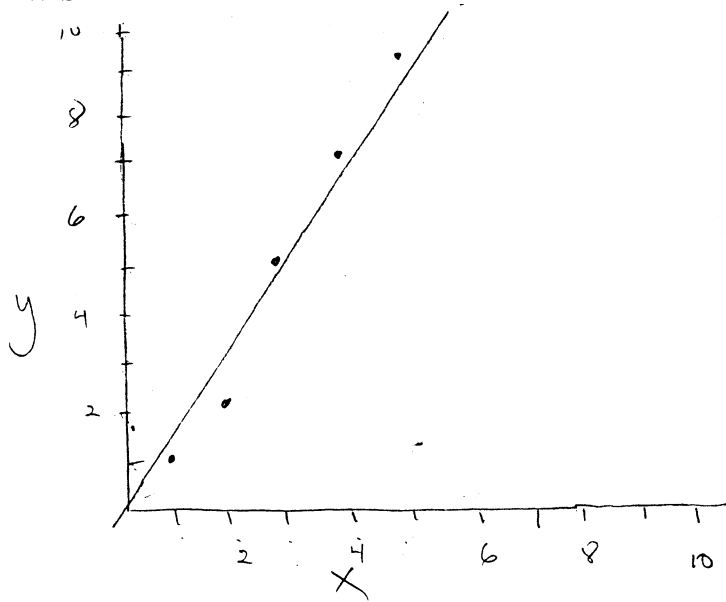
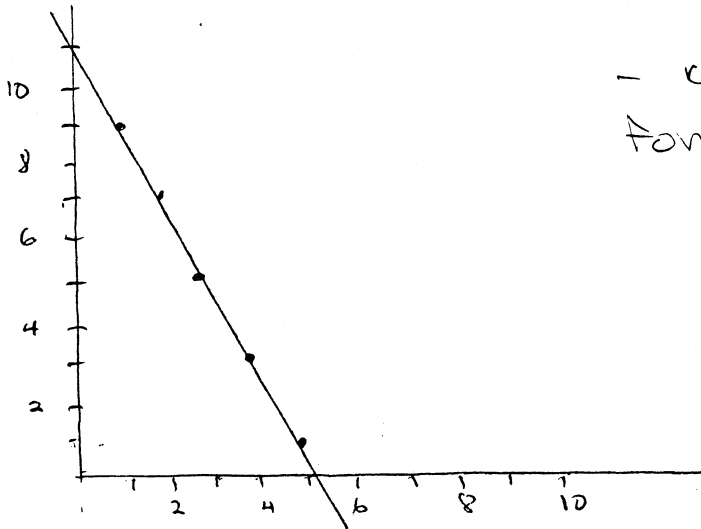


Correlation HW Solutions

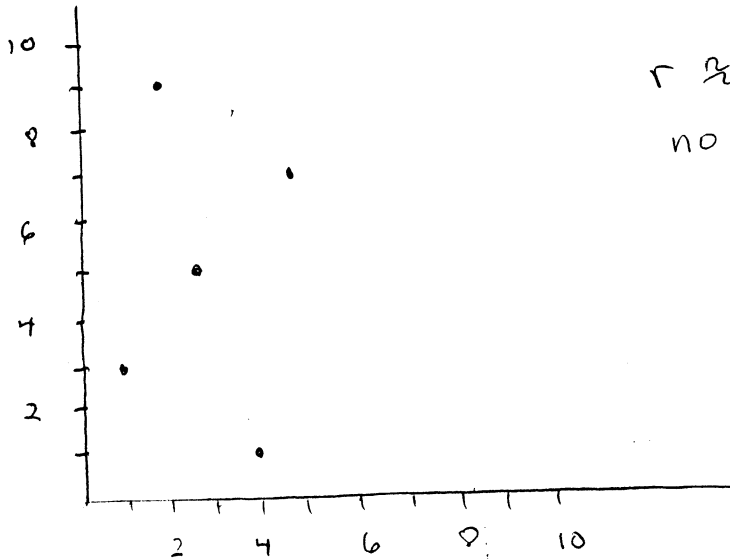
3 a)



+ correlation
form = linear
 $r \approx .9$



- correlation
form = linear
 $r \approx 1.0$



$r \approx 0$
no apparent linear
correlation

b) $r = \frac{SP}{\sqrt{SS_x SS_y}}$

x	x ²	y	y ²	xy
1	1	1	1	1
2	4	3	9	6
3	9	5	25	15
4	16	7	49	28
5	25	9	81	45
<hr/>				
$\Sigma x = 15$	$\Sigma x^2 = 55$	$\Sigma y = 25$	$\Sigma y^2 = 165$	$\Sigma xy = 95$

$$SP = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 95 - \frac{(15)(25)}{5} = 95 - \frac{375}{5} = 95 - 75 = 20$$

$$SS_x = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 55 - \frac{15^2}{5} = 55 - 45 = 10$$

$$SS_y = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 165 - \frac{25^2}{5} = 165 - 125 = 40$$

$$r = \frac{20}{\sqrt{(10)(40)}} = \frac{20}{\sqrt{400}} = \frac{20}{20} = 1.0$$

x	x ²	y	y ²	xy
1	1	9	81	9
2	4	7	49	14
3	9	5	25	15
4	16	3	9	12
5	25	1	1	5
<hr/>				
$\Sigma x = 15$	$\Sigma x^2 = 55$	$\Sigma y = 25$	$\Sigma y^2 = 165$	$\Sigma xy = 55$

$$SP = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 55 - \frac{(15)(25)}{5} = 55 - 75 = -20$$

$$SS_x = 10$$

$$SS_y = 40$$

$$r = \frac{-20}{\sqrt{(10)(40)}} = \frac{-20}{20} = -1.00$$

X	y	x y	x ²	y ²
1	3	3	1	9
2	9	18	4	81
3	5	15	9	25
4	1	4	16	4
5	7	35	25	49

$$\Sigma x = 15 \quad \Sigma y = 25 \quad \Sigma xy = 75 \quad \Sigma x^2 = 55 \quad \Sigma y^2 = 165$$

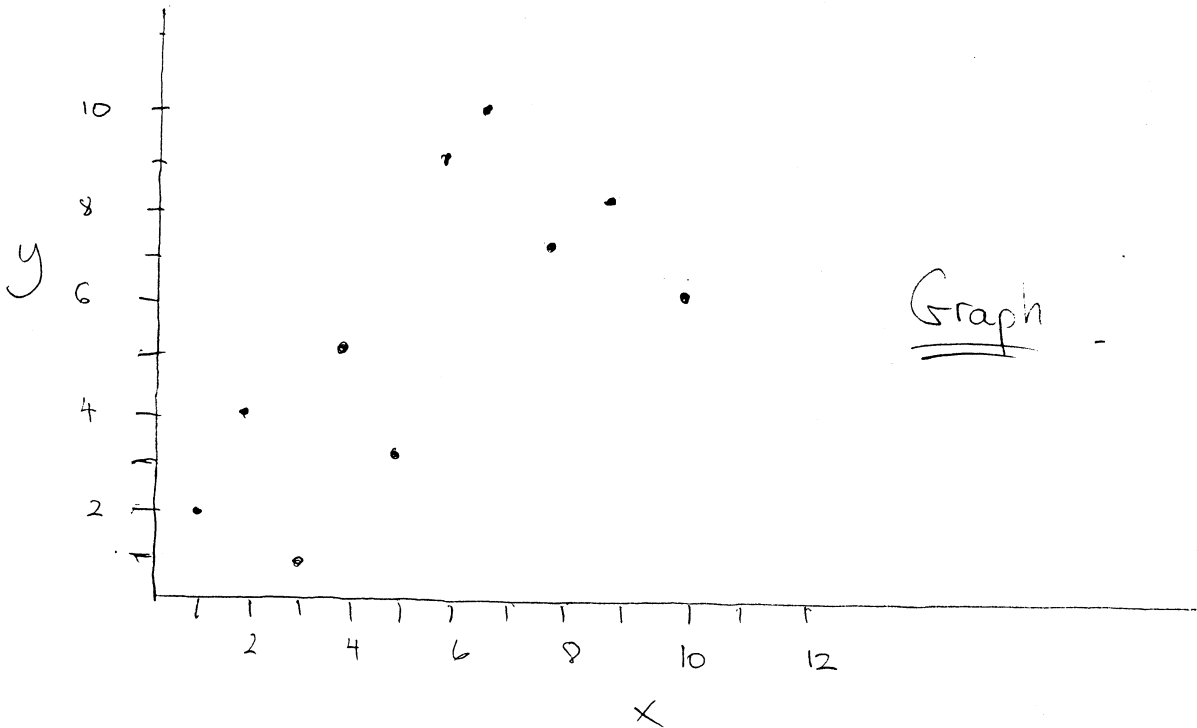
$$SP = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 75 - \frac{(25)(15)}{5}$$

$$= 75 - 75 = 0$$

$$r = \frac{0}{\sqrt{(10)(40)}} = \frac{0}{20} = 0$$

Prob. 5 Data

X	y	x y	x ²	y ²
1	2	2	1	4
2	4	8	4	16
3	1	3	9	1
4	5	20	16	25
5	3	15	25	9
6	9	54	36	81
7	10	70	49	100
8	7	56	64	49
9	8	72	81	64
10	6	60	100	36
$\Sigma x = 55$	$\Sigma y = 55$	$\Sigma xy = 360$	$\Sigma x^2 = 385$	$\Sigma y^2 = 385$



$$b) r = \frac{SP}{\sqrt{SS_x SS_y}}$$

$$SP = \frac{\sum xy - \frac{\sum x \sum y}{n}}{n} = \frac{360 - \frac{(55)(55)}{10}}{10}$$

$$= 360 - 302.5 = +57.5$$

$$SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 385 - \frac{55^2}{10}$$

$$= 385 - 302.5 = \boxed{82.5}$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n} = 385 - \frac{55^2}{10} = \boxed{82.5}$$

$$r = \frac{-57.5}{\sqrt{82.5^2}} = \frac{-57.5}{82.5} = +.697$$

$$= \underline{\underline{+.70}}$$

c)

x	y	xy	x ²	y ²	
1	2	2	1	4	
2	4	8	4	16	
3	1	3	9	1	
4	5	20	16	25	
5	3	15	25	9	
$\Sigma x = 15$		$\Sigma y = 15$	$\Sigma xy = 48$	$\Sigma x^2 = 55$	$\Sigma y^2 = 55$

$$SP = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 48 - \frac{(15)(15)}{5} = 48 - 45 = 3$$

$$SS_x = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 55 - \frac{15^2}{5} = 55 - 45 = 10$$

$$SS_y = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 55 - \frac{15^2}{5} = 10$$

$$r = \frac{SP}{\sqrt{(SS_x)(SS_y)}} = \frac{3}{\sqrt{10 \cdot 10}} = \frac{3}{10} = \underline{\underline{.3}}$$

d)

x	y	xy	x ²	y ²	
6	9	54	36	81	
7	10	70	49	100	
8	7	56	64	49	
9	8	72	81	64	
10	6	60	100	36	
$\Sigma x = 40$		$\Sigma y = 40$	$\Sigma xy = 312$	$\Sigma x^2 = 330$	$\Sigma y^2 = 330$

d) cont.

$$SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 330 - \frac{40^2}{5} = 330 - 320 = 10$$

$$SS_y = \text{same} = 10$$

$$SP = \sum xy - \frac{\sum x \sum y}{n} = 312 - \frac{(40)(40)}{5} = 312 - 320 = -8$$

$$r = SP / \sqrt{(SS_x)(SS_y)}$$

$$r = \frac{-8}{\sqrt{(10)(10)}} = \underline{\underline{-0.80}}$$

e) The correlations for parts c and d were computed for a restricted range of scores and do not accurately represent the full range of x & y values.

②

Person	Ex Pat. (x)	Health Rat (y)	x^2	y^2	xy
A	9	10	81	100	90
B	1	3	1	9	3
C	10	6	100	36	60
D	3	3	9	9	9
E	5	4	25	16	20
F	8	4	64	16	32
	$\sum x = 36$	$\sum y = 30$	$\sum x^2 = 280$	$\sum y^2 = 186$	$\sum xy = 214$

$$r = SP / \sqrt{(SS_x)(SS_y)}$$

$$SP = \sum xy - \frac{\sum x \sum y}{n}$$

$$= 214 - \frac{(36)(30)}{6} = 214 - 180 = \underline{\underline{34}}$$

$$\textcircled{8} \text{ a) } SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 280 - \frac{36^2}{6} = 280 - 216 = 64$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n} = 186 - \frac{30^2}{6} = 186 - 150 = 36$$

$$r = \frac{34}{\sqrt{(64)(36)}} = \underline{\underline{.708}}$$

b) No you cannot. Exercise and health have been shown to be related (correlated). To show causation you would need to systematically manipulate the amount of exercise while holding other variables constant & then look for a relationship with health.

14. Sub	IO(x)	RT(y)	x^2	y^2	xy
A	118	238	13924	56644	28084
B	124	198	15376	39204	24552
C	105	220	11025	48400	23100
D	98	216	9604	46656	21168
E	115	223	13225	49729	25645
F	128	206	16384	42436	26368
	688	1301	79538	283069	148917

(14) cont.

$$a) r = \frac{SP}{\sqrt{SS_x SS_y}}$$

$$\begin{aligned} SP &= \sum xy - \frac{\sum x \sum y}{n} \\ &= 148917 - \frac{(688)(1301)}{6} \\ &= 148917 - 149181 = -264 \end{aligned}$$

$$\begin{aligned} SS_x &= \sum x^2 - \frac{(\sum x)^2}{n} = 79538 - \frac{688^2}{6} \\ &= 79538 - 78891 = 647 \end{aligned}$$

$$\begin{aligned} SS_y &= \sum y^2 - \frac{(\sum y)^2}{n} = 283069 - \frac{1301^2}{6} \\ &= 283069 - 282100 = 969 \end{aligned}$$

$$r = \frac{264}{\sqrt{(647)(969)}} = \underline{\underline{-0.33}}$$

b) Sample correlation is not significant.
 With $n=6$, the critical value is .811 at .05. The r_{obt} is less than this critical value.

or

Not signif because r_{obt} of .33 is less than r_{crit} of .811.

15.

Hours (x)	Num Wrong (y)	x^2	y^2	xy
4	5	16	25	20
0	12	0	144	0
2	3	4	9	6
3	1	9	1	3
6	4	36	16	24
$\Sigma x = 15$	$\Sigma y = 25$	$\Sigma x^2 = 65$	$\Sigma y^2 = 195$	$\Sigma xy = 53$

$$a) SP = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 53 - \frac{(15)(25)}{5}$$

$$= 53 - 75$$

$$= -22$$

$$SS_x = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 65 - \frac{15^2}{5} = 65 - 45 = 20$$

$$SS_y = \Sigma y^2 - \frac{(\Sigma y)^2}{n} = 195 - \frac{25^2}{5} = 195 - 125 = 70$$

$$r = \frac{-22}{\sqrt{(20)(70)}} = \underline{\underline{-0.588}}$$

b) Ranks

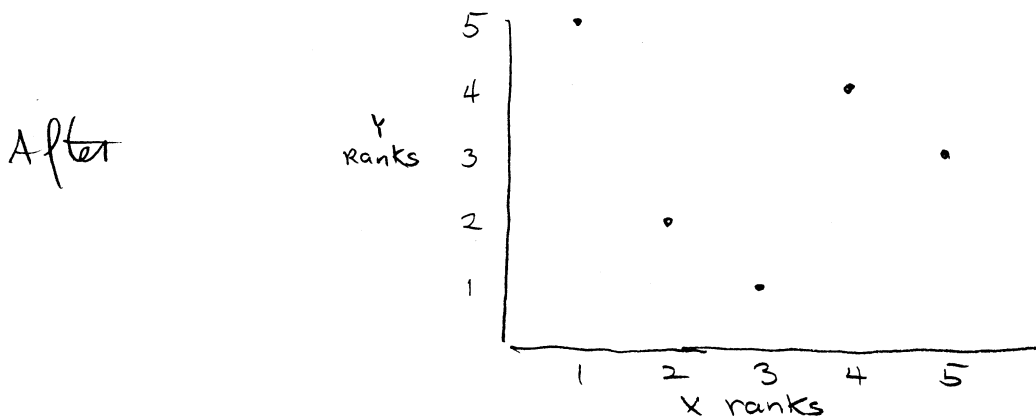
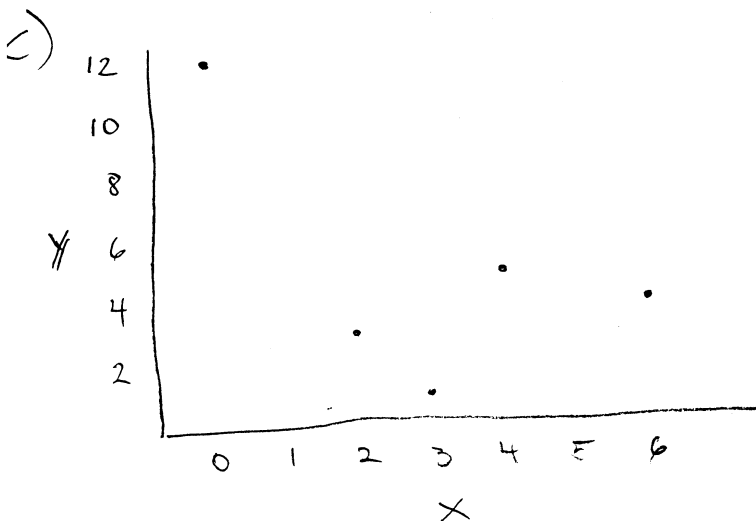
x	y	x^2	y^2	xy
4	4	16	16	16
1	5	1	25	5
2	2	4	4	4
3	1	9	1	3
5	3	25	9	15
$\Sigma x = 15$	$\Sigma y = 15$	$\Sigma x^2 = 55$	$\Sigma y^2 = 55$	$\Sigma xy = 43$

$$SP = \sum x_{ij}y_{ij} - \frac{\sum x \sum y}{n} = 43 - \frac{(15)(15)}{5} = 43 - 45 = -2$$

$$SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 55 - \frac{15^2}{5} = 55 - 45 = 10$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n} = 55 - \frac{15^2}{5} = 55 - 45 = 10$$

$$r = \frac{-2}{\sqrt{(10)(10)}} = \underline{\underline{-0.20}}$$



(16.)

TRAINING	No TRAININGS
9	4
7	7
6	3
10	6

a) Convert into form for point biserial correlation

Training vs Tr.	Quiz Score			
X	Y	X ²	Y ²	xy
1	9	1	81	9
1	7	1	49	7
1	6	1	36	6
1	10	1	100	10
0	4	0	16	0
0	7	0	49	0
0	3	0	9	0
0	6	0	36	0

$$\sum X = 4 \quad \sum Y = 52 \quad \sum X^2 = 4 \quad \sum Y^2 = 376 \quad \sum xy = 32$$

$$b) SP = \sum xy - \frac{\sum x \sum y}{n} = 32 - \frac{(4)(52)}{8} = 32 - 26 = 6$$

$$SS_x = \sum x^2 - \frac{(\sum x)^2}{n} = 4 - \frac{(4)^2}{8} = 4 - 2 = 2$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n} = 376 - \frac{52^2}{8} = 376 - 338 = 38$$

$$r = \frac{SP}{\sqrt{SS_x SS_y}} = \frac{6}{\sqrt{(2)(38)}} = \underline{\underline{0.688}}$$