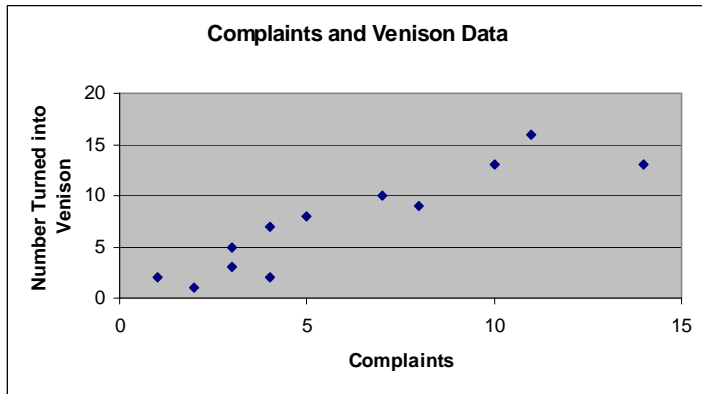


Homework 7 (Correlation) Answers

1.
a. Scatterplot / Scattergram



d. Correlation Calculations

1.d.	X	Y	XY	X ²	Y ₂
	2	1	2	4	1
	1	2	2	1	4
	3	3	9	9	9
	4	2	8	16	4
	3	5	15	9	25
	5	8	40	25	64
	4	7	28	16	49
	7	10	70	49	100
	8	9	72	64	81
	10	13	130	100	169
	11	16	176	121	256
	14	13	182	196	169
Σ	72	89	734	610	931

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}} =$$

$$= \frac{734 - \frac{(72)(89)}{12}}{\sqrt{610 - \frac{(72)^2}{12}} \sqrt{931 - \frac{(89)^2}{12}}} = \frac{734 - \frac{6,408}{12}}{\sqrt{610 - \frac{5,184}{12}} \sqrt{931 - \frac{7,921}{12}}}$$

$$= \frac{734 - 534}{\sqrt{610 - 432} \sqrt{931 - 660.0833}} = \frac{200}{\sqrt{178} \sqrt{270.9167}} = \frac{200}{(13.3417)(16.9595)} = \frac{200}{219.5977} = .9108$$

$$r^2 = .8296$$

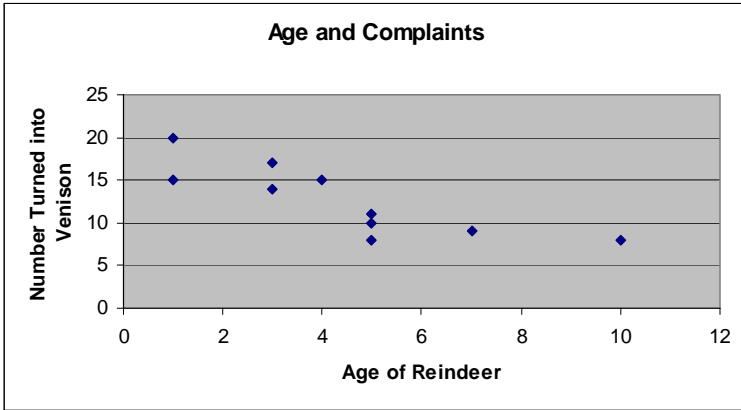
$$1 - r^2 = .1704$$

e. $r(10) = .91, p < .01$. Critical Value for r (@ .01, for $df = 10$) = .708

f. There is a strong positive correlation between the number of complaints and the number of reindeer turned into venison. The more reindeer that complain, the more that are turned into venison.

2.

a. Scatterplot / Scattergram



2.d.	X	Y	XY	X ²	Y ²
	1	20	20	1	400
	1	15	15	1	225
	3	17	51	9	289
	3	14	42	9	196
	4	15	60	16	225
	5	11	55	25	121
	5	8	40	25	64
	5	10	50	25	100
	7	9	63	49	81
	10	8	80	100	64
	Σ	44	476	260	1765

b. Correlation Calculations

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}} =$$

$$= \frac{476 - \frac{(44)(127)}{10}}{\sqrt{260 - \frac{(44)^2}{10}} \sqrt{1765 - \frac{(127)^2}{10}}} = \frac{734 - \frac{5,588}{10}}{\sqrt{260 - \frac{1,936}{10}} \sqrt{1765 - \frac{16,129}{10}}}$$

$$= \frac{476 - 588.8}{\sqrt{260 - 193.6} \sqrt{1765 - 1,112.9}} = \frac{-82.8}{\sqrt{66.4} \sqrt{152.1}} = \frac{-82.8}{(8.1486)(12.3329)} = \frac{-82.8}{100.4959} = -.8239$$

$$r^2 = .6788$$

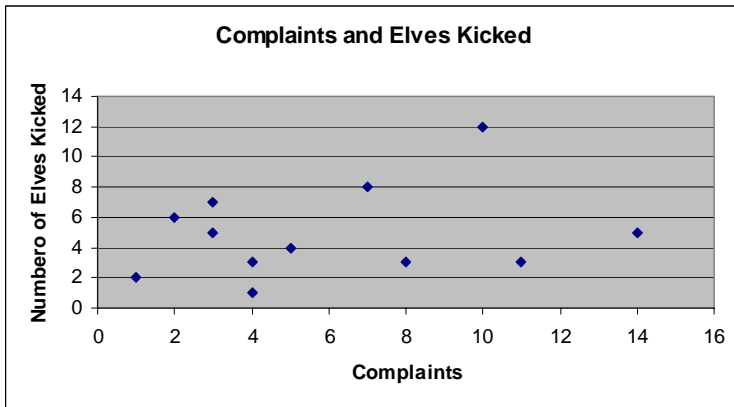
$$1 - r^2 = .3212$$

e. $r(8) = -.82, p < .01$. Critical Value for r (@ .01, for $df = 8$) = .765

f. There is a strong negative correlation between the age of reindeer and the number of complaints each reindeer made in a year. The older reindeer complain complained less.

3.

a. Scatterplot / Scattergram



b. Correlation Calculations

3.d.

	X	Y	XY	X ²	Y ₂
	2	6	12	4	36
	1	2	2	1	4
	3	5	15	9	25
	4	1	4	16	1
	3	7	21	9	49
	5	4	20	25	16
	4	3	12	16	9
	7	8	56	49	64
	8	3	24	64	9
	10	12	120	100	144
	11	3	33	121	9
	14	5	70	196	25
Σ	72	59	389	610	391

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}} =$$

$$= \frac{389 - \frac{(72)(59)}{12}}{\sqrt{610 - \frac{(72)^2}{12}} \sqrt{391 - \frac{(59)^2}{12}}} = \frac{389 - \frac{4,248}{12}}{\sqrt{610 - \frac{5184}{12}} \sqrt{319 - \frac{3481}{12}}}$$

$$= \frac{389 - 354}{\sqrt{610 - 432} \sqrt{391 - 290.0833}} = \frac{35}{\sqrt{178} \sqrt{100.9167}} = \frac{35}{(13.3417)(10.0457)} = \frac{35}{134.0267} = .2611$$

$$r^2 = .0682$$

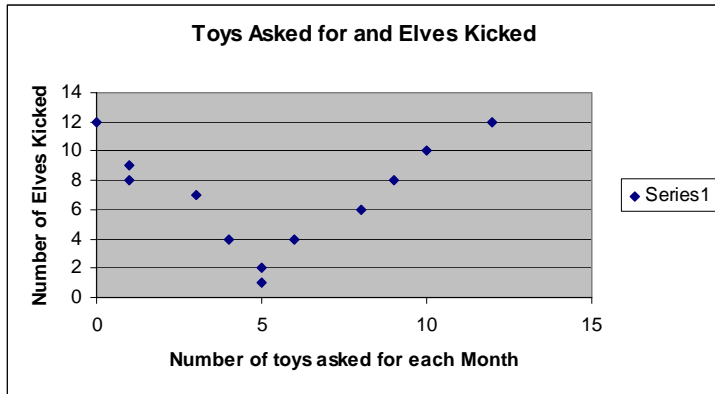
$$1 - r^2 = .9318$$

e. $r(8) = .26, p > .05, NS$. Critical Value for r (@ .05, for $df = 10$) = .576

f. Though non significant, there is a moderate positive correlation between the the number of complaints Santa recieves in a month and the number of elves that he kicks.

4.

a. Scatterplot / Scattergram



d. Correlation Calculations

4.d.	X	Y	XY	X ²	Y ₂
	0	12	0	0	144
	1	9	9	1	81
	1	8	8	1	64
	3	7	21	9	49
	4	4	16	16	16
	5	2	10	25	4
	5	1	5	25	1
	6	4	24	36	16
	8	6	48	64	36
	9	8	72	81	64
	10	10	100	100	100
	12	12	144	144	144
Σ	64	83	457	502	719

$$r = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}} =$$

$$= \frac{457 - \frac{(64)(83)}{12}}{\sqrt{502 - \frac{(64)^2}{12}} \sqrt{719 - \frac{(83)^2}{12}}} = \frac{457 - \frac{5,312}{12}}{\sqrt{502 - \frac{4,096}{12}} \sqrt{719 - \frac{6,889}{12}}}$$

$$= \frac{457 - 442.6667}{\sqrt{502 - 314.3333} \sqrt{719 - 574.0388}} = \frac{14.3333}{\sqrt{160.6667} \sqrt{144.9167}} = \frac{14.3333}{(12.6754)(12.0381)} = \frac{14.3333}{152.5877} = .0939$$

$r^2 = .0088$

$1 - r^2 = .9912$

e. $r(8) = .09, p > .05, NS$. Critical Value for r (@ .05, for $df = 10$) = .576

f. Though non significant, there is a very small positive correlation between the the number of complaints Santa recieves in a month and the number of elves that he kicks. For a correlation this small, with so few subjects we have almost no confidence that this association is meaningful.

5. Problem 3 and Problem 4 had non-significant correlations.

- For Problem 3, a correlation of .2611 would be significant at the .05 level if we had approximately 60 degrees of freedom (df) and therefore 62 subjects.

- For Problem 4, a correlation of .0939 would be significant at the .05 level if we had substantially more than 100 degrees of freedom (df), however we don't know for sure as, the table does not report critical values for more than 100 degrees of freedom. (A rough estimate would be about 300 subjects would be needed).