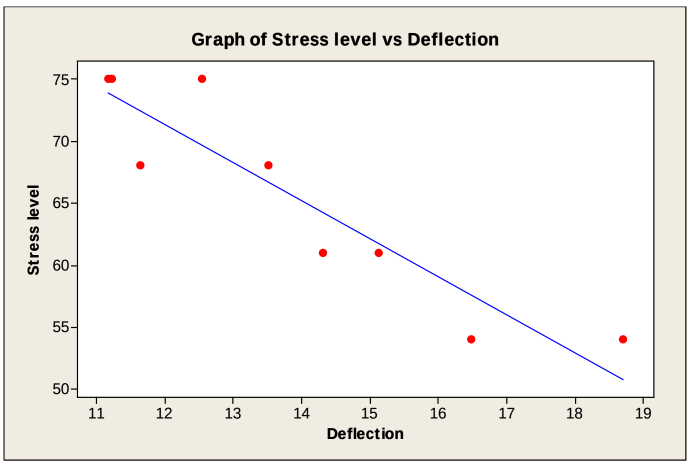
11-16 a)

```
The regression equation is
Deflection = 32.0 - 0.277 Stress level

Predictor          Coef  SE Coef      T      P
Constant         32.049    2.885  11.11  0.000
Stress level   -0.27712  0.04361  -6.35  0.000

S = 1.05743   R-Sq = 85.2%   R-Sq(adj) = 83.1%

Analysis of Variance

Source          DF      SS      MS      F      P
Regression       1  45.154  45.154  40.38  0.000
Residual Error   7   7.827   1.118
Total            8  52.981
```

$\hat{\sigma}^2 = 1.118$



b) $\hat{y} = 32.05 - 0.277(65) = 14.045$

c) (-0.277)(5) = -1.385

d) $\dfrac{1}{0.277} = 3.61$

e) $\hat{y} = 32.05 - 0.277(68) = 13.214 \quad e = y - \hat{y} = 11.640 - 13.214 = 1.574$

11-27 a) $T_0 = \dfrac{\hat{\beta}_0 - \beta_0}{se(\beta_0)} = \dfrac{12.857}{1.032} = 12.4583$

P-value = 2[P(T_8 > 12.4583)] and P-value < 2(0.0005) = 0.001

$$T_1 = \frac{\hat{\beta}_1 - \beta_1}{se(\beta_1)} = \frac{2.3445}{0.115} = 20.387$$

P-value = 2[P(T_8 > 20.387)] and P-value < 2(0.0005) = 0.001

$$MS_E = \frac{SS_E}{n-2} = \frac{17.55}{8} = 2.1938$$

$$F_0 = \frac{MS_R}{MS_E} = \frac{912.43}{2.1938} = 415.913$$

P-value is near zero

b) Because the P-value of the F-test ≈ 0 is less than α = 0.05, we reject the null hypothesis that $\beta_1 = 0$ at the 0.05 level of significance. This is the same result obtained from the T_1 test. If the assumptions are valid, a useful linear relationship exists.

c) $\hat{\sigma}^2 = MS_E = 2.1938$

11-56 a) $14.3107 \le \beta_1 \le 26.8239$

b) $-5.18501 \le \beta_0 \le 6.12594$

c) $21.038 \pm (2.921)\sqrt{13.8092(\frac{1}{18} + \frac{(1-0.806111)^2}{3.01062})}$

21.038 ± 2.8314277

$18.2066 \le \mu_{y|x_0} \le 23.8694$

d) $21.038 \pm (2.921)\sqrt{13.8092(1 + \frac{1}{18} + \frac{(1-0.806111)^2}{3.01062})}$

21.038 ± 11.217861

$9.8201 \le y_0 \le 32.2559$

11-57 a) $-43.1964 \le \beta_1 \le -30.7272$

b) $2530.09 \le \beta_0 \le 2720.68$

c) $1886.154 \pm (2.101)\sqrt{9811.21(\frac{1}{20} + \frac{(20-13.3375)^2}{1114.6618})}$

1886.154 ± 62.370688

$1823.7833 \le \mu_{y|x_0} \le 1948.5247$

d) $1886.154 \pm (2.101)\sqrt{9811.21(1 + \frac{1}{20} + \frac{(20-13.3375)^2}{1114.6618})}$

1886.154 ± 217.25275

$1668.9013 \le y_0 \le 2103.4067$

11-80 a) r = 0.933203

a) $H_0 : \rho = 0$

$H_1 : \rho \ne 0$ α = 0.05

$t_0 = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0.933203\sqrt{15}}{\sqrt{1-(0.8709)}} = 10.06$

$t_{.025,15} = 2.131$

$t_0 > t_{\alpha/2,15}$

Reject H_0

c) $\hat{y} = 0.72538 + 0.498081x$

$H_0 : \beta_1 = 0$

$H_1 : \beta_1 \ne 0$ α = 0.05

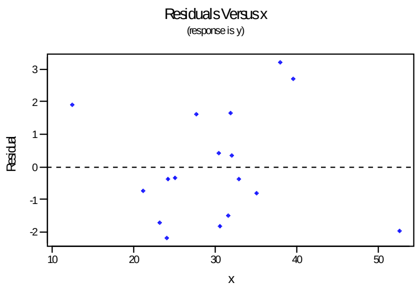
$f_0 = 101.16$

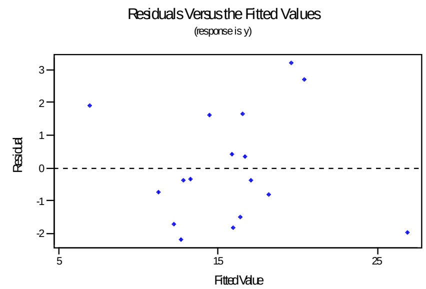
$f_{0.05,1,15} = 4.543$

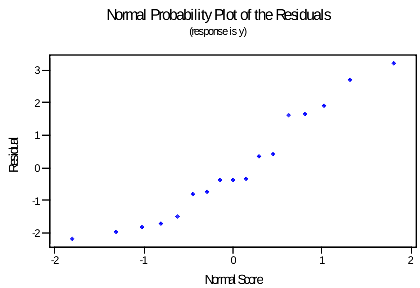
$f_0 >> f_{\alpha,1,15}$

Reject H_0. Conclude that the model is significant at α = 0.05. This test and the one in part b) are identical.

d) No problems with model assumptions are noted.





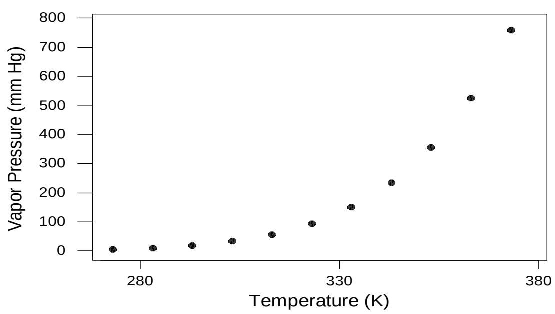


11-87 a) Yes, $\ln y = \ln \beta_0 + \beta_1 \ln x + \ln \varepsilon$

a) No

b) Yes, $\ln y = \ln \beta_0 + x \ln \beta_1 + \ln \varepsilon$

c) Yes, $\frac{1}{y} = \beta_0 + \beta_1 \frac{1}{x} + \varepsilon$



11-108

```
The regression equation is
Population = 3549143 + 651828 Count


Predictor      Coef  SE Coef      T      P
Constant    3549143   131986  26.89  0.000
Count        651828   262844   2.48  0.029
```

```
S = 183802   R-Sq = 33.9%   R-Sq(adj) = 28.4%


Analysis of Variance

Source          DF           SS           MS     F      P
Regression       1  2.07763E+11  2.07763E+11  6.15  0.029
Residual Error  12  4.05398E+11  33783126799
Total           13  6.13161E+11
```

$$\hat{y} = 3549143 + 651828x$$

Yes, the regression is significant at $\alpha = 0.05$. Care needs to be taken in making cause and effect statements based on a regression analysis. In this case, it is surely not the case that an increase in the stork count is causing the population to increase, in fact, the opposite is most likely the case. However, unless a designed experiment is performed, cause and effect statements should not be made on regression analysis alone. The existence of a strong correlation does not imply a cause and effect relationship.