1 Solutions to review problems #1

Here are solutions to the first set of review problems:

4.87: The sampling distribution of $\bar{y}$ is normal with mean $\mu_{\bar{y}} = 60$ and standard deviation $\sigma_{\bar{y}} = \sigma / \sqrt{n} = 5 / \sqrt{16} = 1.25$. Since the distribution of $\bar{y}$ is normal, approximately 95% of the values of $\bar{y}$ should fall within $\mu_{\bar{y}} \pm 1.96 \sigma_{\bar{y}}$ which is 60 ± 1.96(1.25), giving the interval (57.05, 62.95).

5.55 a) A 99% confidence interval for $\mu$ is given by $\bar{y} \pm t_{0.005,14} s / \sqrt{n} = 31.47 \pm 2.977 (5.04) / \sqrt{15} = 31.47 \pm 3.87$, which gives the interval (27.6, 35.34).

b) The question is a bit unclear on exactly what a null hypothesis might be, but if we choose $H_0 : \mu = 35$, then at the $\alpha = .01$ significance level we will fail to reject $H_0$, since the 99% confidence interval includes $\mu = 35$.

11.35 a) Yes, the plotted points seem to follow a line.

b) From the printout, $\hat{y}_i = 12.51 + 35.83 x_i$.

11.36 a) $\hat{\sigma}^2 = \frac{1}{n-2} \sum (y_i - \hat{y}_i)^2 = MSE = 1.069$.

b) From the printout, s.e.( $\hat{\beta}_1$) = 6.96.

c) For this research hypothesis, $H_0 : \beta_1 = 0$ and $H_a : \beta_1 > 0$ since they are interested in detecting a positive relationship. The $p$ value in the printout for $H_0 : \beta_1 = 0$ is $p = .0004$, but the printout is for the two-sided alternative hypothesis $H_a : \beta_1 \neq 0$. Thus, to get the $p$ value for our one-sided alternative hypothesis we divide the printed $p$ value by 2, yielding $p = .0004 / 2 = .0002$.

11.39 a) See the plot using SAS or SYSTAT.

b) The estimated regression equation is $\hat{y}_i = 99.78 + 5.19 x_i$, and the residual standard deviation is $\hat{\sigma}_e = \sqrt{MSE} = \sqrt{148.999} = 12.12$.

c) A 95% confidence interval for $\beta_1$ is given by $\hat{\beta}_1 \pm t_{0.025,28}$ s.e.( $\hat{\beta}_1$), yielding $5.19 \pm 2.048 (.0586)$ or $5.19 \pm .12$, giving an interval of (5.07, 5.31).

11.40 a and b) From the printout, $t = 88.53$, with a $p$ value of $p < .0001$.

11.41 a) $F = 7837.26$, and $p < .0001$.

b) They are equal, because both tests are testing the same null hypothesis when we do simple linear regression. The test statistics are related by $t^2 = F$. 

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