1 Solutions to review problems #1

Here are solutions to the first set of review problems:

4.77: The sampling distribution of $\overline{y}$ is normal with mean $\mu_{\overline{y}} = 60$ and standard deviation $\sigma_{\overline{y}} = \sigma/\sqrt{n} = 5/\sqrt{16} = 1.25$. Since the distribution of $\overline{y}$ is normal, approximately 95% of the values of $\overline{y}$ should fall within $\mu_{\overline{y}} \pm 1.96\,\sigma_{\overline{y}}$ which is 60 ± 1.96(1.25), giving the interval (57.55, 62.45).

5.39 a) A 99% confidence interval for μ is given by $\overline{y} \pm t_{.005,14}\, s/\sqrt{n} = 31.47 \pm 2.977\,(5.04)/\sqrt{15} = 31.47 \pm 3.87$, which gives the interval (27.6, 35.34).

b) Here $H_0 : \mu = 35$ and $H_a : \mu < 35$, and $t = (31.47 - 35)/(5.04/\sqrt{15}) = -2.71$. We reject H_0 if $t < -t_{\alpha,n-1} = -t_{.01,14} = -2.62$. Our observed t value is less than this tabled value, so we reject H_0, and conclude that mean miles driven before wearing out is less than 35,000. The significance level is $P(t \leq -2.71)$ (also called the p value) which is between .005 and .01 if we are using the t table.

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

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

11.58 a) $\widehat{\sigma}^2_\varepsilon = \frac{1}{n-2}\sum(y_i - \widehat{y}_i)^2 = MSE = 1.069$.

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

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 $p = .0004/2 = .0002$.

11.27 a) The plot looks good, there could be one or more influential points.

b) The estimated regression equation is $\widehat{y}_i = 99.68 + 51.92\,x_i$.

c) The residual standard deviation is $\widehat{\sigma}_\varepsilon = \sqrt{MSE} = \sqrt{148.999} = 12.13$.

d) A 95% confidence interval for β_1 is given by $\widehat{\beta}_1 \pm t_{.025,28}\, s.e.(\widehat{\beta}_1)$, yielding $51.92 \pm 2.048\,(.583)$ or 51.9 ± 1.2, giving an interval of (50.7, 53.1).

e) The intercept β_0 is the cost if no stickers were printed, and the slope β_1 is the change in cost for every unit change in stickers (here it is thousands of stickers).

11.28 a and b) From the printout, $t = 89.13$, with a p value of $p < .0001$.

11.29 a) $F = 7943.7$, 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 $t^2 = F$.