Solutions

 # 26, page 226, Chapter 5

H_0: $\mu = 6$

H_1: $\mu \neq 6$ $\qquad \alpha = 0.05$

$$t = \frac{\overline{X} - \mu_0}{\frac{s}{\sqrt{n}}}, \text{ df} = 19$$

Reject H_0 if $t \leq -2.093$ or if $t \geq 2.093$; $\overline{X} = 5.395$; $s = 0.552005911$;

$$t = \frac{\overline{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{5.4 - 6}{0.55/\sqrt{20}} = -4.901473329$$

Reject H_0 since $-4.90 \leq -2.093$. We have significant evidence, $\alpha = 0.05$, to show that $\mu \neq 6$, p-value < 0.01.

 # 28, page 226, Chapter 5

$$ES = \frac{|\mu_1 - \mu_0|}{\sigma} = \frac{10}{15} = \frac{2}{3} = 0.6667$$

$$n = \left[\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES}\right]^2 = \left[\frac{1.96 + 0.84}{0.67}\right]^2 = 17.6, \; n = 18.$$

 # 8, page 284, Chapter 6

H_0: $\mu_1 = \mu_2$

H_1: $\mu_1 > \mu_2$ $\qquad \alpha = 0.05$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Reject H_0 if $Z \geq 1.645$

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} = \sqrt{\frac{s_1^{\,2} + s_2^{\,2}}{2}} = \sqrt{\frac{(12.6)^2 + (14.3)^2}{2}} = 13.5$$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{85 - 72}{13.5\sqrt{\frac{1}{75} + \frac{1}{75}}} = 5.90$$

Reject H_0 since $5.90 \geq 1.645$. We have significant evidence, $\alpha = 0.05$, to show that $\mu_1 > \mu_2$, p<0.0001.

#13, page 285, Chapter 6

a) There are differences between the treatment groups with respect to age p = 0.0090, educational level p = 0.0453, the mean numbers of episodes per week p < 0.0001, and the severity of symptoms p = 0.0021. Income levels are also marginally significant between groups p = 0.0918.

b) Since p-value is 0.0090 < 0.05 there is a significant difference in patient's age between experimental treatment and placebo. **Author requested solution:**

Preliminary Test $H_0: \sigma_1^2 = \sigma_2^2$

$H_1: \sigma_1^2 \neq \sigma_2^2$ $\alpha = 0.05$

Reject H_0 if $F \geq 1.59$ or if $F \leq 1/1.59 = 0.63$

$F = s_1^2/s_2^2 = (5.6)^2/(5.2)^2 = 1.16.$

Do not reject H_0 => Case 2.

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ $\alpha = 0.05$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Reject H_0 if $Z \leq -1.960$ or if $Z \geq 1.960$

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} = \sqrt{\frac{s_1^2 + s_2^2}{2}} = \sqrt{\frac{(5.6)^2 + (5.2)^2}{2}} = 5.4$$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{52 - 54}{5.4\sqrt{\frac{1}{100} + \frac{1}{100}}} = -2.62$$

Reject H_0 since $-2.62 \leq -1.960$. We have significant evidence, $\alpha = 0.05$, to show that $\mu_1 \neq \mu_2$, $p<0.010$.

c) Since p-value is $< 0.00001 < 0.05$ there is a significant difference in patient's mean number of episodes per week between experimental treatment and placebo. **Author requested solution:**

Preliminary Test

$H_0: \sigma_1^2 = \sigma_2^2$

$H_1: \sigma_1^2 \neq \sigma_2^2$ $\alpha = 0.05$

Reject H_0 if $F \geq 1.59$ or if $F \leq 1/1.59 = 0.63$

$F = s_1^2/s_2^2 = (3.2)^2/(2.9)^2 = 1.22.$

Do not reject H_0 => Case 2.

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ $\alpha = 0.05$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Reject H_0 if $Z \leq -1.960$ or if $Z \geq 1.960$

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} = \sqrt{\frac{s_1^2 + s_2^2}{2}} = \sqrt{\frac{(3.2)^2 + (2.9)^2}{2}} = 3.1$$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{8 - 6}{3.1\sqrt{\frac{1}{100} + \frac{1}{100}}} = 4.56$$

Reject H_0 since $4.56 \geq 1.960$. We have significant evidence, $\alpha = 0.05$, to show that $\mu_1 \neq \mu_2$, $p < 0.00001$.