1. Problem 7.12 from the Moore text

a) Given: \( \bar{X} = $332; s = $108; n = 200; \alpha = .01 \)

\( H_0: \mu = 0 \)
\( H_a: \mu > 0 \) (the credit card company hopes consumers will spend more)

\[
t = \frac{\bar{X} - \mu}{s/\sqrt{n}} = \frac{332 - 0}{108/\sqrt{200}} = \frac{332}{7.6368} = 43.47
\]

\( df = n - 1 = 199; t^* = 2.364; p\text{-value} < .0005 \)

Reject the null hypothesis. The average amount spent by customers was significantly higher than before the annual fee was waived. The new policy did increase credit card usage.

b) Construct a 99% confidence interval.

\( df = 199; 99\% \text{ confidence}; t^* = 2.626 \)

\[
c.i. = \bar{X} \pm t^* \left( \frac{s}{\sqrt{n}} \right) = 332 \pm 2.626 \left( \frac{108}{\sqrt{200}} \right) = 332 \pm 2.626(7.6368) = 332 \pm 20.05 = 311.95 \text{ to } 352.05
\]

We have 99% confidence that the mean increase in spending is between $311.95 and $352.05.

c) The sample is large. Outliers would be the potential problem. There are no outliers, so we can use the procedure.

d) We could choose a comparison group of randomly selected credit card customers to whom the offer was not extended. After one year, we could compare the spending behavior of the two groups to determine if the new policy or the stronger economy affected spending.
2. Problem 7.49 from the Moore text

<table>
<thead>
<tr>
<th>Group label</th>
<th>Group number</th>
<th>N</th>
<th>$\bar{X}$</th>
<th>s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>1</td>
<td>10</td>
<td>-3.67</td>
<td>33.89</td>
</tr>
<tr>
<td>Adults</td>
<td>2</td>
<td>20</td>
<td>-23.17</td>
<td>50.74</td>
</tr>
</tbody>
</table>

a) $H_0$: $\mu_1 = \mu_2$
$H_a$: $\mu_1 \neq \mu_2$

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}} = \frac{-3.67 - (-23.17)}{\sqrt{\left(\frac{33.89^2}{10} + \frac{50.74^2}{20}\right)}} = \frac{19.50}{15.61} = 1.25$$

$df = 10 - 1 = 9$; p-value $= 2 \times (.10 to .15) = .20 to .30$

Fail to reject the null hypothesis. There is no significant difference in VOT between the children and adults. If we rejected the null hypothesis, the chance that we are wrong is between 20% and 30%.

b) Construct a 95% confidence interval. $df = 9$; $t^* = 2.262$

$$95\% c.i. = (\bar{X}_1 - \bar{X}_2) \pm t^* \sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)} = [-3.67 - (-23.17)] \pm 2.262 \sqrt{\left(\frac{33.89^2}{10} + \frac{50.74^2}{20}\right)} = 19.50 \pm 2.262(15.61) = 19.50 \pm 35.31 = -15.81 to 54.81$$

We are 95% confident that the difference in VOT between children and adults in the population is between $-15.81$ and $54.81$ milliseconds. Since the interval covers the value of zero, showing no difference between children and adults, we must conclude there is no difference. (We already knew the interval would contain 0 because we failed to reject the null hypothesis of no difference in the previous hypothesis test.) The results show that it is possible for the VOT of children to be either higher or lower than the VOT of adults.
3. Problem 8.10 from the Moore text

Given: \( n = 1048 \); 692 have TVs in their room; 189 named Fox as their favorite network

\[
\hat{p}_{TV} = \frac{692}{1048} = .66; \quad \hat{p}_{Fox} = \frac{189}{1048} = .18
\]

a) Construct a 95% confidence interval for the population proportion of teenagers who have TVs in their room and a 95% confidence interval for the population proportion of teenagers who named Fox as their favorite network.

\[
c.i._{TV} = \hat{p}_{TV} \pm Z^* \left( \sqrt{\frac{\hat{p}_{TV}(1-\hat{p}_{TV})}{n}} \right) = .66 \pm 1.96 \left( \sqrt{\frac{.66(.34)}{1048}} \right) = .66 \pm 1.96(.015) = .66 \pm .03 = .63 to .69
\]

\[
c.i._{Fox} = \hat{p}_{Fox} \pm Z^* \left( \sqrt{\frac{\hat{p}_{Fox}(1-\hat{p}_{Fox})}{n}} \right) = .18 \pm 1.96 \left( \sqrt{\frac{.18(.82)}{1048}} \right) = .18 \pm 1.96(.012) = .18 \pm .02 = .16 to .20
\]

We are 95% confident that the proportion of teenagers in the population having TVs in their room is between .63 and .69, and that the proportion of teenagers in the population naming Fox as their favorite network is between .16 and .20.

b) Our results agree with this statement because the margin of error for both intervals is either 3% (TVs in their room) or 2% (Fox is favorite network).

c) Conduct a hypothesis test to determine if there is good evidence that more than half \((p > .50)\) of all teenagers in the population have a TV in their room.

\( H_0: p = .50 \)
\( H_a: p > .50 \)

\[
Z = \frac{\hat{p}_{TV} - p}{\sqrt{\frac{p(1-p)}{n}}} = \frac{.66-.50}{\sqrt{\frac{.50(.50)}{1048}}} = \frac{.16}{.015} = 10.36
\]

p-value < .0002

Reject the null hypothesis. We can conclude that the proportion of teenagers in the population with televisions in their room is significantly greater than .50.