BUS 3613, Business Statistics  
Practice Test 3, Spring 2010

Your test will be of similar content and material, but the questions will be different and the questions may be asked if a different manner. The test questions will come from all the material we have covered in class.

This is a closed book, closed note test, and should be your work only. You may use a calculator as well as the provided formula sheet and tables during this exam. Stay calm, read all of the instructions, and show your work when applicable. If you use your calculator, please indicate what keys you are choosing. Some unjustified answers will receive minimal credit.

1. During the 2008 election year, new polling results were reported daily. In one poll of 900 adults, 580 respondents reported that they were optimistic about the national outlook.

   \[ n = 900 \quad x = 580 \quad \hat{p} = \frac{580}{900} \approx 0.6444 \]

   a. What hypothesis test should be used to test whether or not 65% or more of adults are optimist about the national outlook?  
      One sample proportion (z) test

   b. What are the null and alternative hypothesis for this test? Clearly label your variables.

      \[ H_0: \ p \geq 0.65 \]
      \[ H_a: \ p < 0.65 \]

   c. Find the test statistic.

      By hand: \[ Z = \frac{0.6444 - 0.65}{\sqrt{\frac{0.65(1-0.65)}{900}}} \approx -0.35 \]

      By calculator: One sample prop test

      \[ Z = -0.3494 \]
      \[ p = 0.3634 \]

   d. Find the \( p \)-value.

      Use table .3632

   e. At a significance level of \( \alpha = 0.05 \) should you reject or fail to reject the null hypothesis?

      Fail to reject the null hypothesis.

   f. In a complete sentence, write out the conclusion in the context of this example.

      There is no evidence to suggest that less than 65% of the residents adults are optimistic about the national outlook.
2. Circle T if the statement is true or F if the statement is false

(T) F  If $p = 0.018$, you should reject the null hypothesis if $\alpha = 0.05$.

T (F) If $p = 0.03$, you should reject the null hypothesis if $\alpha = 0.01$.

3. Jupiter Media used a survey to determine how women and men use their free time. Eight hundred men were surveyed and 268 reported that watching television was their most popular leisure time activity while of the 600 women that were sampled 204 reported that watching television was their most popular leisure time activity.

<table>
<thead>
<tr>
<th>Men</th>
<th>$n_1 = 800$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1 = 2.68$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Women</th>
<th>$n_2 = 600$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_2 = 2.04$</td>
<td></td>
</tr>
</tbody>
</table>

a. Find the point estimate of the proportion of men who report that watching television was their most popular leisure time activity.

$$\frac{268}{800} \approx .335$$

b. Find the point estimate of the proportion of women who report that watching television was their most popular leisure time activity.

$$\frac{204}{600} = .34$$

c. Find the point estimate of the difference between the two population proportions.

$$\bar{X}_1 - \bar{X}_2 = .335 - .34 = -.005$$

d. Find the margin of error of $\bar{p}_1 - \bar{p}_2$ at the 95% confidence level.

By hand:

$$\frac{1.96}{\sqrt{\frac{.335(1-.335)}{800} + \frac{.34(1-.34)}{600}}} \approx .0501$$

By Calculator: 2 proportion Z-interval

$$(-.0551, .0451)$$

e. Find the 95% confidence interval for the difference between the two population proportions.

By hand: $-.005 \pm .0501$

By Calculator: 2 proportion Z-interval

$$(-.0551, .0451)$$

f. Write out in a complete sentence what the confidence interval indicates in this context.

We are 95% confident that the difference between the population proportions for men and women is between $-.0551$ and $+.0451$. Since 0 is in this interval, there may not be any significant difference in how women and men spend their free time in regards to watching television.
4. The College Board reported that the average number of freshman class applications to public colleges and university has been historically 6000. During a recent application/enrollment period, a sample of 32 college and universities showed that the sample mean number of freshman class applications was 5812 with a sample standard deviation of 1140.

- What hypothesis test should be used to determine whether or not there has been a change in the mean number of applications?

  One sample \( t \)-test

b. What are the null and alternative hypothesis for this test? Clearly label your variables. Do NOT perform the test.

\[
\begin{align*}
H_0: \mu &= 6000 \\
H_a: \mu &\neq 6000
\end{align*}
\]

\( \mu \): mean number of freshman class applications to public colleges and universities.

5. The National Association of Home Builders provided data on the cost of the most popular home remodeling projects. Sample data on cost in thousands of dollars for two types of remodeling projects are as follows.

<table>
<thead>
<tr>
<th>Pop. 1</th>
<th>Pop. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen</td>
<td>Master Bedroom</td>
</tr>
<tr>
<td>24.2</td>
<td>18.2</td>
</tr>
<tr>
<td>18.4</td>
<td>22.9</td>
</tr>
<tr>
<td>23.8</td>
<td>26.4</td>
</tr>
<tr>
<td>21.9</td>
<td>25.8</td>
</tr>
<tr>
<td>22.7</td>
<td>26.9</td>
</tr>
</tbody>
</table>

a. What hypothesis test should be used to determine whether or not kitchen remodeling projects cost on average less than master bedroom remodeling projects?

Two sample \( t \)-test

b. What are the null and alternative hypothesis for this test? Clearly label your variables. Do NOT perform the test.

\[
\begin{align*}
H_0: \mu_1 &\geq \mu_2 \\
H_a: \mu_1 &< \mu_2
\end{align*}
\]

\( \mu_1 \): mean cost for kitchen remodeling projects.

\( \mu_2 \): mean cost for master bedroom remodeling projects.
6. Safegate Foods, Inc., is redesigning the checkout lanes in its supermarkets throughout the country and is considering two designs. Tests on customer checkout times conducted at two stores where the two new systems have been installed result in the following summary of the data.

\[
\begin{align*}
\text{System A} & \quad \text{System B} \\
\bar{x}_1 &= 4.1 \text{ minutes} & \bar{x}_2 &= 3.4 \text{ minutes} \\
\sigma_1 &= 2.2 \text{ minutes} & \sigma_2 &= 1.5 \text{ minutes}
\end{align*}
\]

a. What hypothesis test should be used to determine whether the population mean checkout times of the two systems differ? **Two Sample Z-test**

b. What are the null and alternative hypothesis for this test? Clearly label your variables. Do NOT perform the test.

\[
\begin{align*}
H_0: & \quad \mu_1 = \mu_2 \\
H_a: & \quad \mu_1 \neq \mu_2
\end{align*}
\]

7. Scott Marketing Research is conducting a market share study. Over the past year market shares stabilized at 30% for company A, 50% for company B, and 20% for company C. Recently company C developed a “new and improved” product to replace its current entry in the market. Company C retained Scott Marketing Research to determine whether the new product will alter market shares. The market research firm used a consumer panel of 200 customers for the study. Each individual was asked to specify a purchase preference among the three alternatives. Some of the data is provided below.

\[
\begin{align*}
100 & \quad p_0 = .30, \quad p_8 = .5 \\
20 & \quad p_c = .20
\end{align*}
\]

\[
\begin{array}{|c|c|c|c|}
\hline
& \text{Observed Value} & \text{Expected Value} & \frac{(f_i - e_i)^2}{e_i} \\
\hline
30\% & A & 48 & 60 & 2.40 \\
50\% & B & 98 & 100 & 0.04 \\
20\% & C & 54 & 40 & 4.90 \\
\hline
\end{array}
\]

a. Fill in the blanks in the table below:

b. What are the degrees of freedom for the goodness of fit test?

\[
2
\]

c. What is the value of the \(\chi^2\) test statistic?

\[
7.34
\]

d. What is the \(p\)-value? From Table

\[
0.25 < p < 0.05
\]

e. At a significance level of \(\alpha = 0.05\) should you reject or fail to reject the null hypothesis?

Reject null hypothesis.

e. In a complete sentence, write out the conclusion in the context of this example.

There is evidence to suggest that the market shares have indeed changed.
8. Money Magazine reports expense ratios for mid-cap stock funds, small-cap stock funds, hybrid stock funds and specialty stock funds as indicated below.

<table>
<thead>
<tr>
<th>Midcap</th>
<th>Small-cap</th>
<th>Hybrid</th>
<th>Specialty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>2.0</td>
<td>2.0</td>
<td>1.6</td>
</tr>
<tr>
<td>1.1</td>
<td>1.2</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>1.0</td>
<td>1.7</td>
<td>1.8</td>
<td>2.6</td>
</tr>
<tr>
<td>1.2</td>
<td>1.8</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>1.4</td>
<td>1.3</td>
<td>0.3</td>
<td>0.7</td>
</tr>
</tbody>
</table>

a. What hypothesis test should be used to determine whether or not there is a significant difference in the mean expense ratio among the four types of stock funds?

\[ H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 \]

b. What are the null and alternative hypothesis for this test? Clearly label your variables. Do NOT perform the test.

\[ H_0: \text{means are all equal} \]

\[ H_a: \text{means are not equal} \]

9. Based on a random sample of 1120 Americans 15 years of age or older, the mean amount of sleep per night is 8.17 hours according to the American Time Use Survey conducted by the Bureau of Labor Statistics. Assume the population standard deviation for amount of sleep per night is 1.2 hours.

\[ n = 1120 \]
\[ \bar{x} = 8.17 \]
\[ \sigma = 1.2 \]

a. Find the margin of error at the 95% confidence level.

By hand: \( 1.96 \sqrt{\frac{1.2^2}{1120}} \approx 0.0703 \)

By calculator: Do b first

\[ 8.17 - 0.0703 = 8.0997 \]

b. Find the 95% confidence interval for the mean amount of sleep per night of Americans 15 years of age or older.

By hand: \( 8.17 \pm 0.0703 \)

\((8.0997, 8.2403)\)

By calculator - One sample Z-interval

\((8.0997, 8.2403)\)

\( \approx 8.0997 \)

\( \approx 8.2403 \)

\((8.0997, 8.2403)\)

b. Interpret in a complete sentence what information is conveyed by the 95% confidence interval you found in part b.

We are 95% confident that the mean amount of sleep for Americans 15 years or older is between 8.0997 and 8.2403 hours.
10. A simple random sample with \( n = 54 \) provided a sample mean of 22.5 and a sample standard deviation of 4.4. \( \bar{x} = 22.5, s = 4.4 \)

a. Find the degrees of freedom for this sample.
\[ df = 54 - 1 = 53 \]

b. Find the margin of error for this sample at the confidence level of 90%.

By hand:
\[ t = 1.674 \]
\[ 1.674 \cdot \frac{s}{\sqrt{n}} \approx 1.0023 \]

By calculator:
\[ 22.5 - 21.498 = 1.002 \]

\( \alpha = 0.05 \)

By hand:
\[ 22.5 \pm 1.0023 \]

By calculator:
\[ (21.4977, 23.5023) \]

11. The travel-to-work time for residents of the 15 largest cities in the United States is reported. Suppose that a preliminary simple random sample of residents of San Francisco is used to develop a planning value of 6.25 minutes for the population standard deviation. At a 95% confidence level, what sample size should be used to ensure a margin of error of 2 minutes in estimating the population mean travel-to-work time for San Francisco residents?

\[ \bar{x} = 6.25 \]
\[ z = 1.96 \]
\[ mE = 2 \]

\[ n = \frac{(1.96)^2 \times (6.25)^2}{2^2} \approx 37.51 \]

Need to use a sample size of at least 38.