The first four questions are multiple choice. For each question, circle the best answer. [3 points each]

1. A radio show runs a phone-in survey each morning. One morning the show asked its listeners, “Do you think the economy is on the road to recovery?” The majority of those phoning in their responses (102/156) answered “Yes.” The station reported the results as statistically significant. From this we may safely conclude

a) A majority of all Americans think the economy is on the road to recovery.
b) A majority of all radio listeners think the economy is on the road to recovery.
c) A majority of all listeners to that program think the economy is on the road to recovery.
d) Very little other than the majority of those phoning in their responses think the economy is on the road to recovery.

2. Suppose you are going to sample likely voters to find out what proportion favor a certain political candidate for office. You plan on showing this proportion as a 95% confidence interval. In an earlier sample, of 800 people, 35% favored the candidate. Use this earlier result to help determine what the smallest sample size you need so that the margin of error of the new result is at most ±1%?

a) 45  
b) 1068  
c) 8740  
d) 9604

3. Researchers want to see if students taking the SAT test for the second time have a higher mean than those taking it for the first time. To test this, a random sample of the SAT scores of 100 students who took the test for the second time was obtained. The SAT scores for this same group of students for the first time they took the test was then obtained and a test of significance was performed and a conclusion was made. Which of the following would represent a type II error for this situation?

a) The mean difference in the two test scores is greater than zero and we conclude that the mean difference is greater than zero.
b) The mean difference in the two test scores is greater than zero and we do not conclude that the mean difference is greater than zero.
c) The mean difference in the two test scores is zero and we conclude the mean difference is greater than zero.
d) The mean difference in the two test scores is zero and we do not conclude that the mean difference is greater than zero.
4. You are thinking of using a $t$ procedure to test hypotheses about the mean of a population using a significance level of 0.05. You suspect the distribution of the population is not normal and may be skewed. Which of the following statements is correct?

a) You may use the $t$ procedure, provided your sample size is large, say at least forty.

b) You should not use the $t$ procedure because the population does not have a normal distribution.

c) You may use the $t$ procedure, but you should probably only claim the significance level is 0.10.

d) You may not use the $t$ procedure. The $t$ procedures are robust to nonnormality for confidence intervals but not for tests of hypotheses.

5. The average mean body temperature is typically thought to be 98.6°F. A researcher thinks that it is lower. A simple random sample of the body temperatures of 16 adults was taken and the results are found below. Using the data below, conduct a test of significance to determine if the mean body temperature of all adults is less than 98.6°F. Make sure you include the hypotheses, test statistic, P-value, and conclusion. [12 pts.]

97.4, 97.6, 99.3, 98.2, 97.2, 98.2, 98.6, 97.4, 97.9, 97.5, 98.2, 97.1, 98.2, 98.4, 97.9, 99.2
6. Student researchers staked out Holland’s north side Wendy’s restaurant and timed how long it took customers in the drive thru to go from ordering to getting their food. They watched 27 cars go through the drive thru and found a mean time of $\bar{x} = 93.96$ seconds and a standard deviation of $s = 46.66$ seconds. Find a 95% confidence interval for the mean time it takes a Wendy’s customer to go ordering to getting their food. [6 pts.]

7. Do Americans have a more favorable opinion than Canadians of American multinational companies? To answer this question a recent Harris poll was conducted. Of the 1010 Canadians polled, 212 had a positive opinion of American multinational companies. Of the 1017 Americans polled, 274 had a positive opinion of American multinational companies. Conduct a test of significance ($\alpha = 0.05$) to determine if a larger proportion of Americans have a positive opinion of American multinational companies than Canadians do. Make sure you include the hypotheses, test statistic, P-value, and conclusion. [12 pts.]
8. Do seniors watch more TV than sophomores? Using independent random samples, a researcher compares the number of hours of television viewed in one week for high school seniors versus sophomores.

<table>
<thead>
<tr>
<th></th>
<th>Seniors</th>
<th>Sophomores</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{x}_1$</td>
<td>8.9 hours</td>
<td>$\bar{x}_2$ = 8.7 hours</td>
</tr>
<tr>
<td>$s_1$</td>
<td>1.2 hours</td>
<td>$s_2$ = 1.4 hours</td>
</tr>
<tr>
<td>$n_1$</td>
<td>32</td>
<td>$n_2$ = 30</td>
</tr>
</tbody>
</table>

Do these data show that seniors, on average, watch more TV than sophomores? Test this at the $\alpha = 0.05$ level by writing out the hypotheses, finding a test statistic, finding a P-value, and writing a conclusion. [12 pts.]

9. A student researcher found that 194 drivers out of 259 came to complete stops at an intersection where there was a four-way stop. Find a 95% confidence interval for the proportion of drivers that come to complete stops at this intersection. [6 pts.]
10. In a Gallup poll conducted last year, people were asked if they describe their political views as conservative, moderate, or liberal. Results are presented in the table below divided into veterans and non-veterans.

<table>
<thead>
<tr>
<th></th>
<th>Conservative</th>
<th>Moderate</th>
<th>Liberal</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterans</td>
<td>70 /</td>
<td>76 /</td>
<td>22 /</td>
<td>168</td>
</tr>
<tr>
<td>Non-veterans</td>
<td>420 /</td>
<td>261 /</td>
<td>160 /</td>
<td>841</td>
</tr>
<tr>
<td>TOTAL</td>
<td>490</td>
<td>337</td>
<td>182</td>
<td>1009</td>
</tr>
</tbody>
</table>

Is there a relationship between military service and how one describes his or her political views? [12 pts.]

a) If there is no relationship between military service and how one describes his or her political views, find the expected counts for each cell in the table above. Put those expected counts in the cells next to the corresponding observed counts.

b) Conduct a test of significance to see if there a relationship between military service and how one describes his or her political views? Test this at the $\alpha = 0.05$ level by writing out the hypotheses, finding a test statistic, finding a P-value, and writing a conclusion.
11. Girl Scout cookies sold nationally vary according to the following distribution:
   Thin Mints = 25%,  Caramel deLites = 19%,  Peanut Butter Patties = 13%
   Peanut Butter Sandwich = 11%,  Shortbread = 9%,  All Others = 23%.

   My daughters Brownie troop sold 936 boxes of cookies with the following
distribution:
   Thin Mints = 264, Caramel deLites = 216,  Peanut Butter Patties = 156
   Peanut Butter Sandwich = 79,  Shortbread = 70,  All Others = 151.

   We will assume my daughter’s troop counts represent a random sample of all cookies
sold in the Holland area.  /12 pts./

   a) If the cookies sold in the Holland area do not differ from the nation, what are the
expected counts for each type of cookie sold for my daughter’s troop?
   
   Thin Mints = ________,  Caramel deLites = __________,  Peanut Butter Patties = __________
   Peanut Butter Sandwich = __________,  Shortbread = __________,  All Others = __________.

   b) Based on the data, can we conclude that the distribution of cookies sold in
Holland differ from that of the nation?  Test this at the $\alpha = 0.05$ level by writing
out the hypotheses, finding a test statistic, finding a P-value, and writing a
conclusion.
12. Is there a positive relationship between the length of time of an eruption (or duration) of Old Faithful and the time between eruptions? To answer this question, the following data was obtained. (All the numbers represent minutes.) [16 pts.]

<table>
<thead>
<tr>
<th>Duration</th>
<th>4.4</th>
<th>3.9</th>
<th>4.0</th>
<th>4.0</th>
<th>3.5</th>
<th>4.1</th>
<th>2.3</th>
<th>4.7</th>
<th>1.7</th>
<th>4.9</th>
<th>1.7</th>
<th>4.6</th>
<th>1.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Between</td>
<td>78</td>
<td>74</td>
<td>68</td>
<td>76</td>
<td>80</td>
<td>84</td>
<td>50</td>
<td>93</td>
<td>55</td>
<td>76</td>
<td>58</td>
<td>74</td>
<td>56</td>
</tr>
</tbody>
</table>

a) Find a regression equation where duration is the explanatory variable and the time between eruptions is the response variable.

b) Do a test of significance to see if there is a positive relationship between the length of time of an eruption (or duration) and the time between eruptions. Test this at the $\alpha = 0.05$ level by writing out the hypotheses, finding a test statistic, finding a P-value, and writing a conclusion.

We wish to predict the time between eruptions for all durations that lasted 4 minutes. We did this using Minitab with the following output.

<table>
<thead>
<tr>
<th>Duration</th>
<th>Fit</th>
<th>SE Fit</th>
<th>95.0% CI</th>
<th>95.0% PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>75.39</td>
<td>2.12</td>
<td>(70.73, 80.06)</td>
<td>(59.24, 91.55)</td>
</tr>
</tbody>
</table>

c) Suppose we wish to estimate the mean amount of time between eruptions for all durations that lasted 4 minutes. Give a 95% interval for this estimate.

d) Suppose we wish to estimate the amount of time between eruptions for all durations that lasted 4 minutes. Give a 95% interval for this estimate.