1. a) Given that the balance due on Sears charge cards last month is a normally distributed random variable with mean $\mu = 50$ and standard deviation $\sigma = 8$, find: $P(X \geq 40)$, $P(X \leq 54)$, and $P(44 \leq X \leq 56)$.

   b) If a random sample of size N = 64 is drawn from this population, find: $P(\overline{X} \leq 53)$, $P(\overline{X} \geq 49)$, and $P(48 \leq \overline{X} \leq 52)$.

2. A Los Angeles bakery was recently fined $1200 for selling loaves of bread that were underweight. Assume that the LA city attorney has established H_0: $\mu = 24$ oz vs. H_A: $\mu < 24$ oz, where 24 oz is the stated weight of each loaf of bread. A sample of 1861 loaves was taken, and σ is known to equal 1 oz.

   a. Describe, in words, what a Type I and Type II error would be in this circumstance. What would you guess to be the consequences of each type of error in this situation?

   b. Would you accept H_0 or H_A if $\alpha = .01$ and the sample mean were $\overline{X} = 23.75$ oz? Do the calculations by hand and confirm your answer using Stata.

   c. Do you think $\alpha = .01$ is reasonable in this case? Would the decision change if $\alpha = .001$?

   d. Would you buy bread from this bakery?

3. Suppose that you collect the following sample of four observations, drawn randomly from a normal population, representing the monthly rental costs of a 2-bedroom apartment in South Bend, IN: $460, $364, $316, $396. Do the calculations by hand and confirm your answers using Stata and/or SPSS.

   (a) Compute the <u>sample</u> mean and standard deviation.

   (b) What is the probability of obtaining this sample mean or one smaller if the population has mean E(X) = $440 and unknown variance?

   (c) What is the probability of obtaining this sample mean or one smaller if the population has mean E(X) = $440 and a known standard deviation of $\sigma = 56$?

4. A random sample of 25 South Bend adults has a mean of 12.5 years of education and a standard deviation s of 2.2. Test the hypothesis that the population mean is 12.0 using (a) a one-tailed test at the .05 level, and (b) a two-tailed test at the .01 level. Do the same for a sample of size 100 and compare results. Do the calculations by hand and confirm your answers using Stata.

5. Answer each of the following. Keep in mind that you already computed the confidence intervals in homework #3, problem #5, so you do not need to recalculate them (you just have to use them for hypothesis testing). After doing the hand calculations for the hypothesis testing procedure, confirm your answers using Stata and/or SPSS.

a. A recent survey asked respondents to rate, on a scale from 0 to 100, how good a job they thought the President of the United States had done during the past 6 months. Assume that the population variance for this survey equals 100. A random sample of 256 adults yielded a mean score of 61. If $\alpha = .05$ and if H_0 is $\mu = 63$ and H_A is $\mu <> 63$, should you accept or reject H_0? Justify your answer by using both confidence intervals and our usual hypothesis testing procedure.

b. In order to estimate the percent of all housecleaners who use “Wash Away” detergent, 196 housecleaners were randomly selected and interviewed. In the sample, 108 of the housecleaners use this product. If $\alpha = .01$ and H_0 is $p = .5$ and H_A is $p <> .5$, should you accept or reject H_0? Justify your answer by using both the Wilson confidence interval and our usual hypothesis testing procedure. (NOTE: Since you’ve already worked similar problems, the hand calculations are optional; you can just use Stata.)

c. Suppose that you take a survey of the delivery time on a random sample (N = 25) of new Boeing 767s from the date of order, and find the sample mean and variance are 420 days and 25 days, respectively. If $\alpha = .01$ and if H_0 is $\mu = 418$ and H_A is $\mu <> 418$, should you accept or reject H_0? Justify your answer by using both confidence intervals and our usual hypothesis testing procedure.

6. Students currently get an average score of 83 on a particular standardized test. An educator believes that a new program will increase the scores of students. While the randomly selected students who participate in the new program do indeed get higher scores, the 95% confidence interval ranges from 82.9 to 102.5. Because the current average of 83 falls within the CI, the educator reluctantly concludes that the null hypothesis should not be rejected. Do you agree with her decision? Why or why not?