1. A bone health study looked at the daily intake of calcium (mg) for 38 women. In the population of women, the standard deviation is known to be 427.23 mg. However, the researchers are concerned that the mean calcium intake for this population is not meeting the RDA level of 1200 mg, that is, the population mean is less than the 1200 mg level. They wish to test this theory using a 5% significance level.
   a. State the hypotheses.

   b. The researchers find that the mean for the sample is 963.67 mg. Calculate the test statistic and p-value based this data.

   Test statistic = __________
   p-value = __________

   c. Circle the appropriate decision:   Reject Ho    Fail to reject Ho
      Explain your choice.

   d. Use your decision to complete the real-world conclusion that can be made based on this test:

      There (circle one)  is   is not sufficient evidence to say the average calcium intake for women is below the RDA level of 1200 mg.

   e. Sketch a picture of the p-value in terms of an area under a distribution.
2. Company records show that drivers get an average of 32,500 miles with a standard deviation of 1,444 miles on a set of All-Weather tires before an unacceptable level of wear on tires results. Hoping to improve the average, the company has added a new polymer to the rubber that should help protect the tires from wear caused by extreme weather. The results of a preliminary study from twenty randomly selected drivers who tested the new tires gave a sample mean of 33,449 miles. Conduct the appropriate test using a 1% significance level.
   a. Clearly state the hypotheses to be tested.
   b. Conduct the test of the hypotheses specified in part (a).

   Test statistic = _________
   p-value = _________
   Conclusion (circle one): Reject Ho Fail to reject Ho

3. Suppose we wish to test the hypotheses $H_0: \mu = 10$ vs. $H_a: \mu < 10$, where $\mu$ represents the mean age of non-high school aged children who are members of a large gymnastics club in a metropolitan area. A hypothesis test was conducted which resulted in a test statistic of -2.2 and a $p$-value of 0.03. What does the $p$-value tell us? (Circle one)
   a) The probability that the null hypothesis is true.
   b) The probability that the alternative hypothesis is true.
   c) The largest level of significance at which the null hypothesis can be rejected.
   d) The smallest level of significance at which the null hypothesis can be rejected.

4. “It’s a good year for MBA grads” was the title of an article in the Ann Arbor News, (5/30/05). One of the parameters of interest was the population mean expected salary, $\mu$ (in dollars). A random sample of 1000 students who finished their MBA this year (from 129 business schools) resulted in a 95% confidence interval for $\mu$ of (83700, 84800).
   a. What is the value of the sample mean? (Include your units.)
   b. The expected average earnings for such graduates in 2004 was $76,100.
      Suppose we wish to test the following hypotheses at the 5% significance level: $H_0: \mu = 76100$ versus $H_a: \mu \neq 76100$
      Our decision would be (circle one): Reject Ho Fail to reject Ho
      Because ...
5. Trash Bag Strength: Jay Krug works for a distribution company that purchases trash bags from a vendor. The bags are required to have a breaking strength of at least 47 pounds. The bag vendor claims that its production process is relatively stable and produces bags with a mean breaking strength of 53 pounds and a variance of 17.6 pounds. A week ago Jay consulted with you asking how he should go about checking this claim. You suggested obtaining some data.

So Jay strikes an agreement with the vendor that permits him to sample from the vendor’s production process. A sample of 49 bags was randomly selected and the mean breaking strength for the sample was found to be 51 pounds. Jay does remember that sample means are statistics which vary from sample to sample, but he is not sure if his result reflects more variation than due to chance. He seeks your help in interpreting his result.

a. Suppose the bag vendor’s claim is true and many random samples of 49 bags were obtained and for each sample, the sample mean was computed. What is the distribution (model) for the possible values for the sample mean? (Be specific.)

b. Assuming the bag vendor’s claim is true, what is the probability of obtaining a sample mean as far or even farther below the process mean than that observed by Jay? Show all work.

Final answer: ______________

c. What does your answer in part (c) suggest about the validity of the bag vendor’s claim? (circle one)
   • The vendor’s claim is reasonable.
   • The vendor’s claim is not reasonable.

d. Suppose the sample size had been larger. How would the distribution in part (a) have changed? (circle all that apply)
   • the mean would have increased
   • the mean would have decreased
   • the variability would have increased
   • the variability would have decreased
6. A manufacturer of light bulbs selects at random 100 light bulbs from their production line and measures the lifetime of each light bulb in hours (that is, how long the light bulb stays on before it burns out). The resulting data is shown in the histogram below. The manufacturer would like to use this data to estimate the population mean lifetime of its light bulbs.

   ![Histogram showing the distribution of light bulb lifetimes]

a. Based on the histogram, do the data appear to come from a normal population? If yes, state your estimate for the mean of the population. If no, state the shape of the population.

b. The Central Limit Theorem helps us in estimating the population mean lifetime of the light bulbs because: (circle one)
   - It tells us that the test statistic will have a distribution that has the same shape as the population.
   - It tells us that the distribution of the sample mean will have the same shape and mean as the population distribution, but that the variance will be equal to the population variance divided by 100.
   - It tells us that the distribution of the sample mean will be approximately normal with its mean equal to the population mean and its variance equal to the population variance divided by 100.
7. Recently the U.S. 5-cent coin (nickel) has been redesigned. An engineer for a vending machine would like to estimate the average weight of this new coin. He randomly selects 41 of the redesigned nickels. From this sample he found that the average weight was 4.86 grams. Assume that the population standard deviation of weights is 0.5 grams.
   a. Find a 90% confidence interval for the population mean weight of the new nickel.

   Answer: (__________ to __________)

   b. Find a 90% prediction interval for the weight of a new nickel.

   Answer: (__________ to __________)

8. Normal human body temperature is widely believed to be 98.6°F with a standard deviation of 0.68°F. A premed student would like to see if this average is accurate. He randomly samples 52 people and finds their average body temperature to be 98.8°F. Calculate a 95% confidence interval for the population average body temperature.

   Answer: (__________ to __________)