Assignment 5 — Due October 17, 2003

1. Consider taking a random sample from a N(μ,σ^2) distribution where σ is known and has value 8 ($\sigma = 8$). Consider testing the hypothesis $H_0 : \mu = 60$ versus the alternative $H_A : \mu \neq 60$.

   (a) Suppose that a random sample of size 16 is taken and that $\bar{x} = 63$. What is the p-value for your hypothesis test? Are the results significant at 5%?

   (b) Suppose that a random sample of size 64 is taken and that $\bar{x} = 63$. What is the p-value for your hypothesis test? Are the results significant at 5%?

   (c) Suppose that $\sigma = 4$ instead of $\sigma = 8$. Suppose that a random sample of size 16 is taken and that $\bar{x} = 63$. What is the p-value for your hypothesis test? Are the results significant at 5%?

   (d) What conclusions can you reach from your work on this problem?

2. Consider the data on stem volume propagated from healthy buds (from Assignment #1, problem #3). Suppose the claim is made that the mean stem volume for seedlings propagated from healthy buds is 1620 cm^3. Assume that it is known that stem volumes for seedlings from healthy buds follow approximately a normal distribution. Assume also that the variance is known and that $\sigma^2 = (220)^2$. That is, if X is the stem volume of an individual seedling, then $X \sim N(\mu, 220^2)$. State symbolically the null and alternative hypotheses. Find the p-value for the test of the claim. Are the results significant at $\alpha = 10\%$? at $\alpha = 5\%$? at $\alpha = 1\%$? Interpret your findings in terms of the amount of evidence against the null hypothesis.

3. The temperatures at which bean leaflets freeze are known to follow (approximately) a normal distribution. A plant pathologist claims that the mean temperature at which bean leaflets freeze is -3.0 C. A random sample of 18 bean leaflets is taken. The freezing temperatures are:

-1.6	-0.9	-1.3	-2.7	-1.9	-2.2	-3.1	-2.3	-2.1
-0.2	-2.7	-2.9	-2.3	-3.8	-3.6	-4.3	-2.0	-3.3

   (a) Make a stem-leaf display of the data. Comment on the appearance of the display.

   (b) Perform a test of the plant pathologist's claim. State symbolically the null and alternative hypotheses. Find the p-value for the test. Do you reject the claim at $\alpha = 0.05$? Is there much evidence against the null hypothesis?

4. A veterinary researcher claims that a new drug will be 70% effective in improving the condition of sheep suffering from a particular illness. To test this claim, a veterinary clinic tries the drug on 80 sheep suffering from the illness.

   (a) The results indicate that there was improvement in the condition of 50 sheep. Is there any evidence against the claim?

   (b) Suppose now the experiment had been conducted with 320 sheep and improvement was noted in the condition of 200 sheep. Test the claim in this circumstance.

   (c) Compare the results from parts (a) and (b). What is the relationship?

5. The claim is made that 45% of the wells in Northern Wisconsin are contaminated. A random sample of 10 wells is selected and it is found that 8 of the wells are contaminated. Perform a test of the claim and interpret the results.

6. The italicized portion of each of the following statements is either True or False. Indicate whether you feel True or False is the correct answer to each statement and provide a short justification.

   (a) A random sample of size 20 is taken from a normal population with mean μ. You wish to test the hypothesis that μ equals 40. For the particular sample that you take, you observe $\bar{x} = 40.3$. *Since $\bar{x}$ is so close to μ we can safely conclude that there is no evidence against the null hypothesis that $\mu = 40$.*

(b) Consider a random variable X with the following probability distribution: $P(X = 0) = .1, P(X = 2) = .5, P(X = 3) = .3, P(X = 4) = .1$. Let μ and σ denote the population mean and standard deviation respectively. Consider a random sample of size 76 ($n = 76$). Let $\bar{X}$ denote the sample mean. *The distribution of the random variable* $W = (\bar{X} - \mu)/(\sigma/\sqrt{n})$ *is approximately* $N(0, 1)$.

Readings:

Week 6:

- Course Notes: Chapter 6