Statistics 110 – Summer II 2006   Name:_____
August 17, 2006
                                    Final

Please complete the following problems. Be sure to ask me if you have any questions or
anything is unclear. Partial credit will be given, so **be sure to show all of your work**. If you
use your calculator, write the information you input into the calculator, or the command you
used.

Thanks for all of your work this summer. Good luck this fall!

1. (10 pts) The length of time needed to fall asleep at night depends on what happened the
    night before. A random sample of 38 college students was kept awake all night and the next
    day (24 hours total). The average time for this group to go to sleep the next night was
    $\bar{x} = 2.5$ minutes, with a standard deviation of $\sigma = 0.7$ minutes.

    a) Construct a 90% confidence interval for μ, the true average length of time for college
        students to fall asleep under these conditions.

    b) What would happen to the confidence interval if we had sampled 50 students instead
        of 38 of them?

    c) What would happen to the confidence interval if we lowered our confidence level
        from 90% to 80%?

2. (6 pts) A high-tech company wants to estimate the mean number of years of college education its employees have completed. A good estimate of the standard deviation for the number of years of college is $\sigma = 1.6$. How large a sample needs to be taken to estimate the mean number of college years to within 0.5 years with 98% confidence?

3. (6 pts) One of the two assumptions about our data that we must have to perform a one-sample t-test procedure is that the data come from a simple random sample.

   a) What is the other assumption we must make?

   b) How would you go about verifying if your data satisfy the second assumption?

4. (12 pts) A researcher is interested in the health of Beluga Whales. One agency contends that the mean thickness of Beluga Whale blubber is 4.3 inches. Our researcher feels that the mean thickness is less than that, and wishes to use a hypothesis test to prove it. He measures the thickness of the whales' blubber at a specific location. He measures 15 whales, and records the following data (in inches):

4.4	3.2	4.3	3.9	4.1
4.4	4.0	4.5	3.6	4.6
4.4	4.3	4.0	4.8	3.9

Assume here that $\sigma = 0.4$ inches.

   a) Write down the appropriate null and alternative hypotheses for the researcher's test.

   b) Would you use a t-test or a z-test here? Explain your reasoning.

   c) What is the value of the test statistic you calculated?

   d) What is the p-value for this hypothesis test?

   e) What is your conclusion? Use $\alpha = 0.05$.

5. (12 pts) A company with a large fleet of cars hopes to keep gasoline costs down, and sets a goal of attaining a fleet average of 26 miles per gallon.

To see if the goal is being met, they check the gasoline usage for 30 company trips chosen at random, finding a mean of $\bar{x} = 25.02$ mpg, and a sample standard deviation of $s = 2.83$ mpg.

Conduct a hypothesis test to see if the company fleet is averaging less than 26 miles per gallon. Be sure to state the null and alternative hypotheses, present your test statistic and p-value, and draw the appropriate conclusion. Use $\alpha = 0.05$.

6. (12 pts) 8 runners were asked to run a 10-kilometer race on 2 consecutive weeks. In the first week they wore shoes from Brand A, and in the second week they wore shoes from Brand B. All of them were times in minutes as given below:

Runner	Brand A	Brand B
1	31.23	32.02
2	29.33	28.98
3	30.50	30.63
4	32.20	32.67
5	33.08	32.95
6	31.52	31.53
7	30.68	30.83
8	31.05	31.10

A local shoe store would like to determine if there is evidence that the mean time using Brand A is less than the mean time using Brand B.

a) Which test would you use here: The one-sample Z-test, matched pairs t-test, one-sample t-test, or two-sample t-test? Explain your reasoning.

b) State the hypotheses that the store would like to test.

c) What is the test statistic and resulting p-value?

d) What can the shoe store conclude? Use $\alpha = 0.10$.

7. (12 pts) A taste testing study had 100 male and 100 female participants to investigate whether taste preferences was related to a person's gender. Both groups rated their preference on a scale of 1 to 10 (1 being 'very unpleasant' and 10 being 'very pleasant'). The mean ratings and sample standard deviations for the males and females are given below:

Females: $\bar{x}_1 = 7.0$ $\quad s_1 = 2.0$ $\quad n_1 = 100$

Males: $\quad \bar{x}_2 = 6.4$ $\quad s_2 = 1.5$ $\quad n_2 = 100$

Let μ_1 and μ_2 represent the mean ratings one would observe for the populations of females and males respectively.

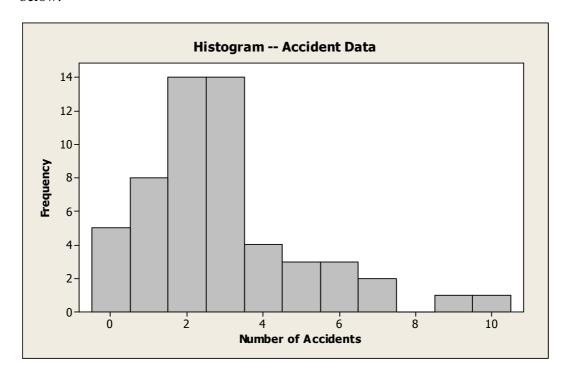a) Calculate a 95% confidence interval for μ_1 - μ_2.

b) Suppose in the above study, a researcher had wished to test the hypotheses

$$H_o: \mu_1 = \mu_2$$
$$\text{versus } H_a: \mu_1 \neq \mu_2 .$$

Perform the relevant hypothesis test. What do you conclude? Use $\alpha = 0.05$.

8. (12 pts) In each of the following situations, state whether or not t-procedures (a t-interval or a t-test) are appropriate.

a) You are studying the number of hours in labor spent by cows. You measure the length of labor for 14 cows at the UCONN dairy barn. A stem-and-leaf plot for a set of data is given on the right. Based on this, do you think that it is appropriate to use t-procedures to create a 95% confidence interval for the mean number of hours spent in labor? Explain your reasoning.

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0 | 33
0 | 5566
1 | 024
1 | 67
2 |
2 | 6
3 | 1
3 |
4 |
4 |
5 | 3
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b) You are studying the number of accidents that student at UCONN have been involved in. You select a random sample of 55 people. A histogram of the data is provided below:

Histogram -- Accident Data

Would a 90% t-interval be reasonable in this situation? Explain your reasoning.

9. (6 pts) You are studying the length of drool coming off of the jowls of St. Bernard dogs. Let μ be the mean length (in cm) of drool. You wish to test the hypotheses:

$$H_0\text{: } \mu = 5$$
$$\text{versus} \quad H_a\text{: } \mu > 5.$$

You plan to measure some dogs and perform the hypothesis test. In terms of this problem, describe the two possible errors that could occur when you make your conclusions.

10. (12 pts) Here are the IQ test scores for 20 seventh-grade girls in a Midwest school district:

114	100	104	89	102	91	114	114	103	105
108	130	120	132	111	128	118	119	86	72

In addition, here are the IQ test scores for 22 seventh-grade boys in the same school district:

111	107	100	107	115	111	97	112	104	106	113
109	113	128	128	118	113	124	127	136	106	123

Use these data to test if there is a difference in the mean IQ scores for boys and girls in this school district. Be sure to state the null and alternative hypotheses, present your test statistic and p-value, and draw the appropriate conclusion. Use $\alpha = 0.05$.

BONUS: (4 pts)
A confidence interval for the mean height of 38 pine trees is (55.28 , 67.34). Suppose we know that the population standard deviation is $\sigma = 26.7$.

What is the confidence level of this confidence interval?