STATISTICAL METHODS

Inquire | Explore | Generalize | Evaluate | Communicate
UNDERSTAND THE UNKNOWN

STATISTICAL METHODS
INFORMATION ON THE THIRD EXAMINATION

Date : November 22, 2010 (Monday)
Time: 9:15-10:20
Place: Sci. 3550
Examination Type: Closed notes and books. But you will be allowed to use one sheet of paper (information sheet) with the formulas and facts that you need (This sheet should not have solutions of problems or examples)
The things that you need for the exam: Photocopies of tables given to you earlier and formula handouts
Coverage: Sections 6.3-8.7 (included)
Interactive Practice Test: http://umconnect.umn.edu/p76475303/

The important topics that you should know for the exam.
6.3 Central Limit Theorem (CLT)
      Sampling distribution of $\bar{x}$
          o The mean
          o The standard deviation, standard error
          o Approximate distribution of the sample mean for large n (CLT)

Chp. 7 Estimation with Confidence Intervals
7.1 Large Sample Confidence intervals for the μ
7.2 Small Sample Confidence Intervals for the μ
7.3 Confidence Interval for a Population Proportion, p.
7.4 Determination of Sample Size
      For the Population Mean
      For the Population Proportion

Chp. 8 Tests of Hypotheses
8.1 Elements of Tests of Hypothesis
8.2 Large Sample Test of Hypothesis About μ
8.3 Observed Significance Level: P-Value
8.4 Small Sample Test of Hypothesis About μ
8.5 Test of Hypothesis About the Population Proportion, p.
8.6 Calculating P(Type II Error) and Power
8.7 Inference About a Population Variance

STUDY QUESTIONS FOR CHAPTERS 6, 7, and 8

1. In 1987, the average annual rate of interest paid by savings and loan institutions in Pennsylvania was 7.26%. Assume a normal distribution and a standard deviation of 1.50% to answer the following questions. What is the probability that a randomly selected 9 such

institutions on the average paid between 7.00% and 8.00% interest on deposits?

2. Unoccupied seats on flights cause airlines to lose revenue. Suppose a large airline wants to estimate its average number of unoccupied seats. To accomplish this, the records of 225 flights are randomly selected, and sample mean is found to be 11.6 seats. Assume that the population standard deviation is known to be 4.1 seats.
a. Estimate $\mu=$ the mean number of unoccupied seats per flight during the past year, using a 90% confidence interval.
b. How large a sample needs to be taken to estimate the mean number of unoccupied seats to within 0.35 seats with 90% confidence?
c. Test the hypothesis H_0: $\mu=13$ seats against the hypothesis H_a: $\mu \neq 13$ at $\alpha=0.01$ level.
d. Find the p-value of the test.

3. A method currently used by doctors to screen women for possible breast cancer fails to detect cancer in 15% of the women who actually have the disease. A new method has been developed that researchers hope will be able to detect cancer more accurately. A random sample of 70 women known to have breast cancer were screened using the new method. Of these, the new method failed to detect cancer in six.
a. State the null and alternative hypotheses.
b. Define Type I and Type II errors in the context of the problem.
c. Do the data provide sufficient evidence to indicate that the new screening method is better than the one currently in use? Use $\alpha=0.05$.
d. Find the prob-value (p-value) of the test
e. Using a 95% confidence interval, estimate the proportion of the women with breast cancer that the new method will fail to detect.

4. A state game protector collects measurements on the weights of species of fish in a lake. The standard deviation of the weights is known to be 2.13 pounds. A total of 49 measurements are obtained and it is determined that sample mean is 7.34.
a. Give a 95% confidence interval for the average weight of that species.
b. How many measurements must be averaged to get a margin of error of ± 0.5 (with a bound of error of 0.5) (the mean to be within 0.5) with 95% confidence?

5. The manufacturer of a certain foreign car sold in the United States claims that it will average 35 miles per gallon of gasoline with the standard deviation of 9.3 miles. To test this claim, a consumer's group randomly selects 40 of these cars and drives them under normal driving conditions. These cars average 28 miles to the gallon. Does this sample indicate that average mileage is more than 35?
a. State H_0 and H_a.
b. Carry out the test and give the P-value. Report your conclusion.
c. Is the result significant at the 5% level ($\alpha = 0.05$)?
d. Find the probability of Type II Error for mean 40.
e. Find the power of the test for the mean 40.

6. A fast food restaurant is considering a new product. It will be worthwhile to introduce this product if the mean sales per store are more than $600 per week. In a marketing

test the product is sold at 26 stores. From the sample it is found that the mean for weekly sales is $603.20 and the standard deviation is $60.

a. State H_0 and H_a.
b. Carry out the test and give the P-value. Report your conclusion.
c. Is the result significant at the 5% level ($\alpha = 0.05$)?
d. Give a 95% confidence interval for the mean sales.

7. (Source: "Demons Begone", *Asheville Citizen-Times,* April 5, 1991) A poll of 1,226 adults revealed that 601 of them believe that the devil may sometimes possess earthlings.
a. Construct a 90% confidence interval for the true proportion of adults who believe that the devil may sometimes possess earthlings.
b. Determine the sample size required the estimate will be within 0.02 of the true proportion with 90% confidence.

8. In May the fill weights of "6-pound" boxes of laundry soap had a mean of 6.13 pounds with a standard deviation of 0.095. The goal was to decrease the standard deviation. The company decided to adjust the filling machines so that the standard deviation will be reduced. In June a random sample of 20 boxes yielded mean of 6.10 and a standard deviation of 0.065.
a. At a 0.05 significance level, was the company successful?
b. Set up a 99% confidence interval for σ^2.