Statistics **NYU – Fall 1999**
Prof. Giorgio Topa **V31.0018 – 004**

FINAL EXAM

December 16th, 1999

Answer each of the questions in the exam books provided. There are 100 total points. Read the questions carefully and keep your answers brief and to the point. PLEASE WRITE NEATLY. Good luck!

Question 1. [10 points]

Latrell Sprewell (New York Knicks) is an excellent free throw shooter and makes 87 % of his free throws (or has an 87 % chance of making a single free throw). Assume that free throw shots are independent of one another. Suppose Latrell gets to shoot four free throws.
(a) *(5 points)* Calculate the probability that he makes all four shots.
(b) *(5 points)* Calculate the probability that he makes at least one of the four free throws.

Question 2. [15 points]

In a study of student loan subsidies, the Dept. of Education reported that 4-year Stafford Loan borrowers will owe an average of $12,168 upon graduation. This average is the sample mean calculated out of a sample of 480 student loans, where the sample standard deviation is $2,200.

(a) *(5 points)* Develop a 90% confidence interval estimate for the population mean amount owed.
(b) *(5 points)* Develop a 99% confidence interval estimate for the population mean amount owed.
(c) *(5 points)* What happens to the width of the confidence interval as the confidence level is increased? Why?

Question 3. [15 points]

Audience data collected at the ESPN SportsZone web-site showed that 26% of the users were women. This percentage was based on a sample of 400 users.

(a) *(5 points)* Using a 95% confidence level, calculate a confidence interval estimate for the population proportion of users that are women.
(b) *(5 points)* What is the margin of error associated with the above confidence interval?
(c) *(5 points)* How large a sample should be taken if the desired margin of error is 3%?

Question 4. [20 points]

New tires manufactured at a company in Findlay, Ohio, are claimed by the company to provide a mean of at least 28,000 miles. Tests with 30 tires show a sample mean of 27,500 miles, and a sample standard deviation of 1,000 miles. Using a .05 significance level, we want to test whether there is sufficient evidence to reject the manufacturer's claim of a mean of at least 28,000 miles.

(a) *(6 points)* State the null and the alternative hypothesis for this test.
(b) *(7 points)* What is the test result?
(c) *(7 points)* What is the p-value of the test?

Question 5. [10 points]

A TV station predicts election winners on the basis of the following hypothesis test, where p is the proportion of voters selecting the leading candidate.

$H_0 : p \leq .50$ $\qquad$ $H_A : p > .50$

If H_0 can be rejected, then the station will predict that the leading candidate is the winner.

(a) *(5 points)* What is the Type I error? What are the consequences of making this error here?
(b) *(5 points)* What is the Type II error? What are the consequences of making this error here?

Question 6. [10 points]

A firm is studying the delivery times of 2 suppliers. The firm is basically satisfied with supplier A and is prepared to stay with them if their mean delivery time is the same as or less than that of supplier B. However, if our firm finds that the mean delivery time of supplier B is less than that of supplier A, it will begin making purchases from B.

(a) *(5 points)* What are the null and alternative hypotheses for this situation?
(b) *(5 points)* Assume that independent samples show the delivery times given below, for the two suppliers. With a .05 significance level, what is your conclusion for the hypothesis in part (a)? What action do you recommend in terms of supplier selection?

DATA

	Supplier A	**Supplier B**
sample size	50	30
sample mean	14 days	12.5 days
sample std. Dev.	3 days	2 days

Question 7. [20 points]

Fowle Marketing Research, Inc. bases charges to a client on the assumption that telephone surveys can be completed within 15 minutes or less. If more time is required, a premium rate is charged. With a sample of 35 surveys, a standard deviation of 4 minutes, and a level of significance of .01, the sample mean will be used to test the null hypothesis H_0: $\mu \leq 15$.

(a) *(5 points)* What is your interpretation of the Type II error for this problem? What is its impact on the firm?
(b) *(5 points)* What is the probability of making a Type II error when the actual mean time is $\mu = 17$ minutes?
(c) *(5 points)* What is the probability of making a Type II error when the actual mean time is $\mu = 18$ minutes?
(d) *(5 points)* What is the definition of the Power of the test? Sketch the power curve for this test.