**ECONOMICS 220: TEST NUMBER 5— Prof. J. E. Floyd**

December 5, 2001

STUDENT NAME:

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AIDS ALLOWED: Calculators only.

Question 1: (25 points)

The developer of a decision-support software package wishes to test whether users consider a color graphics enhancement to be beneficial, on balance, given its list price of $800. A random sample of 100 users of the package will be invited to try out the enhancement and rate it on a scale ranging from -5 (completely useless) to 5 (very beneficial). The test alternatives are $H_0$: $\mu \leq 0$, $H_1$: $\mu > 0$, where $\mu$ denotes the mean rating of users. The $\alpha$ risk of the test is to be controlled at 0.01 when $\mu = 0$. The standard deviation of users' ratings is $\sigma = 1.3$.

a) Show the decision rule for $\bar{X}$ relevant for this test.

b) Calculate the rejection probabilities at $\mu = 0, 0.5, 1.0$ and 1.5 for the decision rule above.

c) Sketch the rejection probability curve for the decision rule you selected above.

d) What is the incorrect conclusion when $\mu = 0.60$? What is the probability that the above decision rule will lead to the incorrect conclusion when $\mu = .60$? Is the probability an $\alpha$ or $\beta$ risk?

Question 2: (25 points)

Based on n = 64 term test and exam questions a statistics professor computes each student's sample mean and standard deviation. This sample information is used to infer each student's level of understanding, denoted $\mu$. It is the professor's policy to fail a student only when he can be 95% sure that this student's level of understanding is less than 50 percent.

a) Explain what the Type I and Type II errors are here? What are the consequences of the professor making a Type I error versus a Type II error in the context of this question?

b) Two students have averages of 48 percent. One of these students has a sample standard deviation $s_1 = 8$ percent while the other has a sample standard deviation of $s_2 = 12$ percent. Suppose that these students have a true level of understanding, $\mu_1$, equal to 46 percent. Calculate $\beta$-risk for each student.

c) Comment on how sample variability, measured by $s$, has affected the Power of this test. Does high variability benefit students with a low average? Explain in the context of hypothesis testing.

Question 3: (25 points)

During a blizzard, 100 persons are arrested on suspicion of looting. Each is given a polygraph test (a lie detector test). From past experience it is known that the test is 90% reliable when administered to a guilty suspect and 98% reliable when given to someone who is innocent. Suppose that of the 100 persons taken into custody, only 12 were actually involved in any wrongdoing. What is the probability that a suspect is innocent given that the polygraph says he is guilty?

Question 4: (25 points)

An aid agency is making an agreement with a group of producers of agricultural products. The agreement stipulates a price per 50-kilogram sack of flour. A sample is to be taken from each shipment by an independent inspection group to test whether the mean weight of the sacks is 50 kilograms. The sellers want to control the risk of rejecting a shipment if the mean weight is equal to or above 50 pounds at 1% while the aid agency wants to set the risk of accepting a shipment for which the mean weight of the sacks is less than 49 pounds at 5%. The sellers agree on a planning value for $\sigma$ of 5. How big should the sample be?