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Bus 274: Further Statistics for Business

Spring 2010

PROBLEM SHEET # 4

Problem 1: Suppose in a sample of 25 people, the sample mean height was observed to be 70 inches. Suppose also that height is normally distributed with a known standard deviation of $\sigma = 3$.

a) Give an example of an industry which will be interested in body heights of people.

b) Construct a 95% confidence interval for μ.

c) Would you reject the hypothesis $H_0 : \mu = 71$ versus $H_1 : \mu \neq 71$ on the basis of the observations, when testing at level $\alpha = 0.05$?

d) Explain in a few words what the terms "type I error" and "type II error" mean in the test problem in (c). Considering the outcome of the test in (c), could we have made a type I or type II error?

e) Now assume the population variance is not known, and 3 is the standard deviation of the sample (that is, $s = 3$). Which test statistic for the test in (c) would you be using in this case?

f) Would you expect the power of the test to increase or to decreased as we change the statement from *"The true mean equals 72"* to *"The true mean equals 78"*?

Problem 2: A manufacturer of tires wants to make sure the tires last on the average at least 22000 miles. Suppose a random sample of five tires had a sample mean of $\bar{x} = 22819$ and a sample standard deviation of $s = \hat{\sigma} = 1295$ miles. We assume that the "life" of a tire, in terms of miles, is normally distributed.

a) Which null hypothesis H_0 has to be tested against which alternative H_1? Why?

b) Carry out the test. Use a significance level of $\alpha = 5\%$.

c) Briefly explain in words what what we can conclude about the quality of the tires in view of the result in (b).

Problem 3: The average daily return (observations from one year, 250 values) on a stock index was 0.3%, and the standard deviation of the daily returns was 2.6%.

a) Test the null hypothesis that the expected daily return is 0%. (Use a 5% level of significance.)

b) Compute the probability that the average daily return for 250 days takes on a value outside the interval $[-0.3\%, +0.3\%]$ under the assumption that the hypothesis under (a) is true. (This is the p-value of the null hypothesis in (a).)