Stat 151.003 Fall 2006 (Kozdron)
Assignment #6

This assignment is due by 3:30 pm on Monday, November 27, 2006, in Dr. Kozdron's office (College West 307.31). You may also hand it in before class that day. You must submit all problems that are marked with an asterix (*). You are encouraged to form study groups and collaborate with others on this assignment. However, the final work you submit must be your own. A piece of advice: *the assignments are worth very little in the computation of your final grade. It is better to suffer through not understanding something now, rather than copying from a friend just for the sake of completion. You will not have that luxury on the exams.* YOUR ASSIGNMENT MUST BE STAPLED AND PROBLEM NUMBERS CLEARLY LABELLED. UNSTAPLED ASSIGNMENTS WILL NOT BE ACCEPTED! DO NOT CROWD YOUR WORK. DO NOT WRITE IN MULTIPLE COLUMNS..

1. * Observational studies suggest that moderate use of alcohol reduces heart attacks, and that red wine may have special benefits. One reason may be that red wine contains polyphenols, substances that do good things to cholesterol in the blood and so may reduce the risk of heart attacks. In an experiment, healthy men were assigned at random to several groups. One group of 9 men drank a half-bottle of red wine each day for two weeks. The level of polyphenols in their blood was measured before and after the two-week period. Here are the percent changes in level:

$$3.5, 8.1, 7.4, 4.0, 0.7, 4.9, 8.4, 7.0, 5.5.$$

If μ denotes the true mean percent change in blood polyphenols among all healthy men who drink a half-bottle of red wine daily, then test

$$H_0 : \mu = 0 \text{ vs. } H_1 : \mu > 0.$$

Is there significant evidence at the $\alpha = 0.01$ level to conclude that there is percent change in blood polyphenols?

2. * The t-statistic for a test of

$$H_0 : \mu = 10$$

$$H_1 : \mu < 10$$

based on $n = 10$ observations has the value $t = -2.25$.

(a) What are the degrees of freedom for this statistic?

(b) Between what two probabilities p from Table F does the P-value of the test fall?

3. * You are testing $H_0 : \mu = 0$ against $H_1 : \mu \neq 0$ based on a simple random sample of 20 observations from a Normally distributed population (where the population standard deviation σ is unknown). What values of the t statistic are statistically significant at the $\alpha = 0.01$ level?

(continued)

4. * Diet colas use artificial sweetners to avoid sugar. These sweeteners gradually lose their sweetness over time. Manufacturers therefore test new colas for loss of sweetness before marketing them. Trained testers sip the cola along with a drink of standard sweetness and score the cola on a "sweetness scale" of 1 to 10. The cola is then stored for a month at high temperature to imitate the effect of four months' storage at room temperature. Each taster scores the cola again after storage. The data given below are the differences (score before storage minus score after storage) in the tasters' scores. The bigger the differences, the bigger the loss of sweetness.

Suppose we know that for any cola, the sweetness loss scores vary from taster to taster according to a normal distribution with population standard deviation $\sigma = 1.0$. The mean μ for all testers measures the loss of sweetness, and is different for different colas.

The following are the sweetness losses for a new cola, as measured by 10 trained tasters:

$$2.0, 0.4, 0.7, 2.0, -0.4, 2.2, -1.3, 1.2, 1.1, 2.3.$$

Most are postive; that is, most tasters found a loss of sweetness. But the losses are small, and two tasters (the ones with negative scores) thought that the cola gained sweetness.

(a) Compute $\overline{X}$, the average sweetness loss for this sample.

(b) Do this data provide good evidence that the cola lost sweetness in storage? (Test this claim at the $\alpha = 0.01$ significance level.)

5. The historian Raymond Dumett of Purdue University was examining British colonial records for the Gold Coast in Africa, and he suspects that the death rate was higher among African miners than among European miners. In the year 1936, incomplete records show there were 223 deaths among 33,809 African miners and 7 deaths among 1541 European miners on the Gold Coast. Determine if there is good evidence that the proportion of African miners who died during 1936 was higher than the proportion of European miners who died during that year by answering the following questions.

(a) Define your notation, and clearly state an appropriate null hypothesis and an appropriate alternative hypothesis.

(b) Calculate the test statistic.

(c) Using your test statistic, give the corresponding P-value.

(d) Clearly state your conclusion in words. That is, explain whether or not there is good evidence at the $\alpha = 5\%$ significance level that the proportion of African miners who died during 1936 was higher than the proportion of European miners who died that year. Your response must include the phrases *African miners*, *European miners*, *Gold Coast*, and *evidence*.