Stat C131A: Lab 5 Worksheet

Problems from Rice: *Mathematical statistics and data analysis*

11.6. Respond to the following:

I have two batches of numbers and I have a corresponding $\bar{x}$ and $\bar{y}$. Why should I test whether they are equal when I can just see whether they are or not?

11.8a. An experiment to determine the efficacy of a drug for reducing high blood pressure is performed using 4 subjects in the following way: 2 of the subjects are chosen at random for the control group and 2 for the treatment group. During the course of treatment with the drug, the blood pressure of each of the subjects in the treatment group is measured for 10 consecutive days as is the blood pressure of each of the subjects in the control group.
In order to test whether the treatment has an effect, do you think it is appropriate to use the two-sample t-test with $n = m = 20$?

11.2. The difference of the means of two normal distributions with equal variance is to be estimated by sampling an equal number of observations from each distribution. If it were possible, would it be better to halve the standard deviations of the populations or double the sample sizes?

11.15. Suppose that n measurements are to be taken under a treatment condition and another n measurements are to be taken independently under a control condition. It is thought that the standard deviation of a single observation is about 10 under both conditions. How large should n be so that a 95% confidence interval for $\mu_X - \mu_Y$ has a width of 2? Use the normal distribution rather than the t distribution, since n will turn out to be rather large.

11.16. Referring to Problem 11.15, how large should n be so that the test of $H_0 : \mu_X = \mu_Y$ against the one-sided alternative $H_A : \mu_X > \mu_Y$ has a power of 0.5 if $\mu_X - \mu_Y = 2$ and $\alpha = 0.10$?

Additional problems

1. Let X have a binomial distribution with parameters $n = 10$ and $p \in \{p : p = \frac{1}{2}, \frac{1}{4}\}$. The (simple) hypothesis $H_0 : p = \frac{1}{2}$ is rejected and the alternative (simple) hypothesis $H_1 : p = \frac{1}{4}$ is accepted if the observed value of X, a random sample of size 1, is less than or equal to 3. Find the significance level and power of the test.

2. Let X have the binomial distribution with parameters n and p. We reject $H_0 : p = \frac{1}{2}$, and accept $H_1 : p > \frac{1}{2}$ if $X \geq c$. Find n and c so that $\alpha = 0.10$ and the power of the test against the alternative $p = \frac{2}{3}$ is $1 - \beta = 0.95$.