Assignment 8 — Due November 7, 2003

1. An experimental treatment is thought to be effective in causing the remission of cancer in rats. An experiment is planned which will involve the administration of the treatment to rats with artificially induced tumors. It is known that, even without treatment, there is a 25% chance that remission will occur. In addition, the nature of the treatment is such that it will not decrease the chance of remission. Of interest, of course, is whether the treatment will increase the chance of remission. In the planned experiment, the treatment will be given to each of 500 rats with tumors. After a fixed period of time the rats are to be sacrificed and the number of rats for which remission has occurred will be counted. The experimenter will reject the null hypothesis that the treatment has no effect if remission occurs in 150 or more rats.

   (a) State symbolically the null and alternative hypotheses, defining all symbols in words.

   (b) What is the α-level of the proposed test?

   (c) If in fact the success rate of the treatment is 35%, what is the power of the test?

   (d) When the experiment was actually carried out, it was found that remission occurred in 154 rats. Find the p-value of the test.

2. The following data are paired yields (in bushels) of two varieties of wheat grown on standard-sized plots. Each pair of plots was in a different location. The plots within a pair were immediately adjacent to one another.

Location	1	2	3	4	5	6	7	8	9	10
Variety I	42.1	36.8	49.4	28.5	51.0	32.9	39.4	43.7	37.5	27.6
Variety II	44.3	38.1	49.4	30.5	52.8	33.7	38.2	47.8	39.1	28.5

   (a) State (briefly) the assumptions you must make to proceed with an analysis of data of this form. (Define all terms.) Where possible, justify the validity of the assumptions.

   (b) Perform (without using the computer) a test to determine whether the mean yield of Variety II differs from the mean yield of Variety I. (State hypotheses, give p-value, etc.)

   (c) Find a 99% CI for the difference between mean yields.

   (d) Explain qualitatively why pairing was important for this experiment.

3. A researcher wishes to compare the mean egg weight of two related species of laboratory birds. Nine randomly selected eggs are obtained from birds of each species with data given below.

Species A	4.25	4.87	5.13	4.85	3.95	5.09	4.36	5.57	4.81
Species B	4.32	4.48	5.05	3.27	4.23	4.41	4.77	3.75	3.90

   (a) State (briefly) the assumptions you must make to proceed with an analysis of this problem. Define all terms. (On this problem you need not justify the assumptions; you will be asked to do this on other problems.)

   (b) Perform (without using the computer) a hypothesis test of the claim that the two species have the same mean egg weight (versus the two-sided alternative). (State the hypotheses, give p-value, etc.)

   (c) Compute a 95% CI for the difference in mean egg weight between the two species.

   (d) Test the hypothesis that the mean egg weight of Species B eggs equals the mean weight of Species A eggs plus 0.5 (versus the 2-sided alternative).

4. Below are the weights (in mg) of the samaras (winged seeds) of two silver maple trees. Your goal is to test the claim that Tree 2 has samaras that are of the same weight as those of Tree 1. Using the techniques of normal inference, perform a test of the claim (without using the computer). State all assumptions (defining the symbols used) and, where possible, explore the validity of the assumptions. Write a short paragraph summarizing your findings on this problem.

Tree 1	169	120	133	145	143	133	150	154	162	151	143	149	139
Tree 2	158	147	164	172	132	158	139	153	149	169			

5. Suppose you have a random sample of size 15 from a normal distribution with mean μ and variance σ^2 and suppose you wish to test $H_0 : \sigma^2 = 4$ versus $H_A : \sigma^2 > 4$ at α =0.05. Find the rejection region (in terms of S^2) for this test and the power at $\sigma^2 = 13$. (When finding the power, you can either do it approximately by using tables, or use R to find it exactly.)

Readings:

- Week 9: Course Notes Chapter 10