ST 432 Homework Set 11
Due Tuesday April 15, 2008

1. Q1 P169 Double Sampling Question

2. In class I have been talking about capture-recapture methods. One method I discussed was the Lincoln Petersen capture recapture method where I was able to simply obtain an explicit estimate for the population size N. This method was based on intuition and could be viewed as similar to the method of moments used in ST 422.

   Here I want you to consider a simple related problem called the two sample removal estimator. Suppose that we have a closed population of size N and we remove n_1 animals at time 1 and then later at time 2 we go back and remove n_2 animals. (The animals are never returned to the popn unlike in capture-recapture). Let use assume that the removal probability (call it p) is constant for both removals. Show that an intuitive estimate is that

$$\hat{N} = \frac{n_1^{\,2}}{(n_1 - n_2)}.$$

   Further as a second part to the question I would like you to use the same approach that I used in class to show the estimate presented above is also the MLE. Do not be intimidated by this problem as it is quite simple once you have seen the other example.. Write down the probability distribution for the first removal n_1 and then the probability distribution for the second removal n_2 conditional on n_1. Multiply them together to get the likelihood function which is a function of N and p and the data. Then proceed in a very similar way to the way I did in class on the Lincoln-Petersen likelihood.