Stat 135, Fall 2006 A. Adhikari

HOMEWORK 2 (due Friday 9/15)

In what follows, $x.y$ means Problem y of Chapter x of the text.

1. Consider the situation of sampling without replacement from a population, with the notation used in lecture. Here are some facts from lecture:

(i) The variance of the sample mean is $\frac{\sigma^2}{n}\frac{N-n}{N-1}$.

(ii) $s_X^2 = \hat{\sigma}_X^2 \frac{n}{n-1}$.

(iii) An unbiased estimate of σ^2 is the $s_X^2(1 - \frac{1}{N})$.

(iv) In the 0-1 case, $\sigma^2 = p(1-p)$ and $\hat{\sigma}_X^2 = \hat{p}(1-\hat{p})$.

In the 0-1 case, construct an unbiased estimate of the variance of the sample proportion. You should be able to do this just from the four lines above. Go to the book if you must, but you really shouldn't have to.

2. 7.14. Do you have to use the result of Problem 1 of this homework? Explain.

3. 7.32. This one is a workout in using the formulas and recalls some probability facts.

4. 7.11. This one is hands-on, concrete, and cute. Once you're done with **a** and **b**, assume $x_i = i$ for $i = 1, 2, 3, 4$ and stay with the sampling scheme in **b**. Draw a histogram of the population and find its mean and standard deviation. Then draw a histogram of the sampling distribution of the sample mean. Find the expectation and standard error of the sample mean.

5. Let X and Y be random variables such that $Var(X) = \sigma^2$, $Var(Y) = \tau^2$, and $Cov(X, Y) = \gamma$. Let a, b, c, d be constants. Find $Cov(aX + bY, cX + dY)$ in terms of the seven constants in this problem.

6. 7.24. This problem gives you another reason to use the sample mean as your estimate. Careful when you compute the variance - the sample is being drawn without replacement.

7. 7.37. Note that the problem doesn't say that the surveys were based on sampling without replacement from the population. So despite the notation, don't assume that either of the two estimates is our old friend the sample mean.

8, 9, 10. 7.28, 7.29, 7.30. In the last one, I look forward to finding out what you consider to be "plausible".