

## Statistics 422 Exam 1 take home questions

Note: since this is part of exam 1, **you are to work individually on these problems**. Do not discuss these questions with anyone except Dr. Williams. Work each problem on a separate page, bring the take home problems (and all intermediate calculations) with you to the in-class exam at lecture 12 (Friday, Feb. 13). One or more of these problems will be handed in with the in-class exam, and information from others will be used on the in-class questions.

1. For the population of size  $N = 5$  given by  $\{1, 3, 5, 7, 9\}$ :
  - (a) Calculate the values of  $\mu$  and  $\sigma^2$ .
  - (b) Calculate the values of  $E(\bar{y})$  and  $V(\bar{y})$  for an SRS sample of  $n = 2$  (without replacement).
  - (c) Calculate the values of  $E(\bar{y})$  and  $V(\bar{y})$  for an SRS sample of  $n = 2$  (with replacement).
  - (d) Of the values for  $V(\bar{y})$  in (b) and (c), which is smaller? Briefly explain why.
2. The owner of a movie rental business wants to estimate the proportion of DVD's that were rented in the past month. She randomly samples 15 of the 85 racks of DVD's in her store, then for each DVD in the rack, she records whether or not it was rented. In this sample, what were each of the following: the population, the frame, the sampling units, and the elements? Of the types of probability sampling methods that we reviewed in Chapter 2, which one does this seem most like - briefly explain.
3. You have been hired to help estimate the average cattle output in the U.S. for last year. The data is available from a company and a fee is charged for each state sampled. If the range of cattle output by state (in 1000 head) is about 14,000 and they wish to have a 95% confidence interval with a bound of 1,000 for the average, how many states should be sampled?
4. Sampling populations of rectangles has recently become popular. A sample of  $n = 10$  rectangles was drawn from a population of  $N = 100$  rectangles, giving areas of: 1, 4, 8, 10, 1, 6, 4, 12, 5, and 4. Estimate the mean  $\mu$  of the population of rectangles, and place a bound on the error of estimation.
5. In a state with approximately 20,000 registered voters, a sample of 500 is taken to estimate what proportion support each of 4 candidates for governor. The results are that 192 support candidate Johnson, 160 support candidate Smith, 97 support candidate Brown, and 51 support candidate Jones.
  - (a) Estimate the proportion  $p$  that support candidate Johnson in the population, and calculate a bound on the error of estimation.
  - (b) Is there a true difference in the proportion of voters supporting candidates Johnson and Smith?