**Midterm 2A–Stat 100–Spring 2001**

You may use a calculator and one page of notes. Each problem is worth 20 points. Different parts of a problem have equal weight unless otherwise indicated. Put a box around the final answer to a question.

1. In a certain city, 20% of the students play sports.
(a) In a random sample of 20 students from this city, what is the probability at least 5 play sports?
(b) In a random sample of 200 students from this city, approximately what is the probability at most 45 play sports?

2. Assume that the standard deviation of the amount of copper precipitate from a chemical experiment is 5.0 grams. How many times should the experiment be repeated if one wants to be 99% sure that the true mean amount of the precipitate is estimated within 1.5 grams?

3. A software company takes on average 150 days to complete a project, with a standard deviation of 20 days. For a random sample of 100 projects, let $\overline{X}$ denote the average time to complete the project.
(a) What is the mean of $\overline{X}$?
(b) What is the standard deviation of $\overline{X}$?
(c) Estimate the probability that $\overline{X}$ lies between 145 and 155.
(d) Briefly justify your answer to (c).

4. A refrigerator company made 3,612 service calls last year. As part of a profitability analysis, the company wishes to estimate the mean number $\mu$ of man-hours expended by company personnel per service call. A random sample of 125 service calls yielded $\overline{x} = 1.54$ man-hours and $s = 1.20$ man-hours, where $x$ denotes the man-hours expended in a service call.
(a) (15 points) Construct a 95% confidence interval for $\mu$. (Do not do any arithmetic or calculator work: just plug the appropriate numbers into the appropriate formula.)
(b) (5 points) If you had constructed a 90% confidence interval, would it have been wider or narrower then the one in part (a)?

5. For each part, answer TRUE or FALSE.

(a) It is reasonable to use the normal approximation for the Binomial(n,p) distribution when n=100 and p=.01 .
(b) The sample variance $S^2$ is an unbiased estimator of the population variance $\sigma^2$, because $E(S^2) = \sigma^2$.
(c) If $X$ is a random variable with mean 0 and standard deviation 1, then
Prob($|X| < 1.96$) = .95 .
(d) When a 95% confidence interval for $\mu$ is computed from sample data, the meaning is the following: if the same procedure is applied to many samples, then for about 95% of the samples, the interval computed will actually contain $\mu$.