Midterm 2B–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 large southern city, 40% of the people have Type O blood.
(a) Out of 20 randomly selected donors from this city, what is the probability that at least 5 have Type 0 blood?
(b) Out of 100 randomly selected donors from this city, approximately what is the probability that at most 43 have Type O blood?

2. From a random sample of 85 third grade students in a large school district, the mean and standard deviation of reading comprehension scores of the California Test of Basic Skills (CTBS) are found to be 71 and 27 respectively.
(a) (15 points) Based on this sample, construct a 95% confidence interval for the mean reading comprehension score for all third grade students in the school district. (Do not do any arithmetic or calculator work: just plug the appropriate numbers into the appropriate formula.)
(b) (5 points) Would a 99% confidence interval be narrower or wider?

3. A company makes an average profit of \$320 per customer, with a standard deviation of \$50 dollars. Let $\overline{X}$ be the average profit made on a random sample of 10,000 customers.
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 \$319 and \$320 .
d) Briefly justify your answer to (c).

4. A sample survey of the kindergarten children in a large city is being planned, to estimate the mean number of older siblings a kindergarten child has. It is desired to estimate this mean so that with a 95% level of confidence, the estimate is within 0.1 of the actual mean. A reasonable planning value for the population standard deviation σ is 0.7.
What sample size is needed for this estimate of the mean number of older siblings?

5. Answer True or False for each part.
(a) $z_{.05} = 1.96$.
(b) If a random variable X has a normal distribution, then the random variable $2 - 5X$ also has a normal distribution.
(c) Let μ denote the average number of cars owned by a household in College Park. Suppose that a researcher takes a survey and from the survey data computes $(1.2, 1.6)$ as a 95% confidence interval for the population mean μ. Then with probability equal to .95, it is true that $1.2 < \mu < 1.6$.
(d) The sample average is a consistent estimator of the population mean, by the Law of Large Numbers: for sufficiently large sample size, the sample average is very close to the population mean, with probability close to 1.