Statistics 431: Statistical Inference
Fall 2006

Problem Set 1 — Due 25 Sep 2006

Devore Chapter 7: #6, 10, 16, 22, 23, 24, 25, 32, 34, 40.

Additionally:

A. At the beginning of Bill Clinton's presidential administration, he spoke on proposed economic reforms. A sample of people who heard the speech ($n = 600$) were asked if they favored higher taxes on all forms of energy; 40% responded "yes." (*Time*, March 1, 1993, p. 26.)

(a) Based on this sample, give a 90% confidence interval for the population proportion of "yes" answers.

(b) What is the population here?

(c) Newspaper and news magazine surveys often report that with 90% confidence, the margin of error of the survey is at most $\pm 3\%$. Did the Time survey above meet these specifications? If not, how many respondents would Time have needed to survey in order to do so?

B. A gasoline company tested the octane ratings of 20 one-gallon samples of gasoline produced during a day. The results were as follows: 87.2, 86.9, 86.5, 87.5, 87.4, 88.1, 86.9, 87.4, 87.1, 87.0, 88.0, 87.3, 86.7, 87.5, 88.0, 87.1, 87.0, 87.4, 87.7, 88.1.

(a) Give a 90% confidence interval for the mean octane rating of the day's production. Assume a normal population. (Use JMP IN, or, to get a feel for the tedium of applied statistics 50 years ago, compute manually.)

(b) Construct a normal quantile plot for this data, using JMP IN, to investigate whether the assumption of normality from part (a) seems plausible. What do you conclude? (Note: This is a relatively small sample – of size $n = 20$ – so any conclusion concerning normality of the population must necessarily be very tentative.)

C. Suppose the gasoline company in problem B performed similar tests on each of 100 days, and thus produced 100 confidence intervals – one for each day. Let Y denote the number of intervals out of the 100 that contain the true mean octane rating of that day's production. Assume the intervals are mutually independent. What is the distribution of Y? What is the probability that $Y \geq 90$? $Y \geq 95$? $Y \geq 99$? [Partial answer: $P(Y \geq 95) = 0.0478$. A normal approximation method that gets you reasonably close to this answer would also provide acceptable solutions to the other questions.]