Chapters 4 and 5

1. A certain assay for serum alanine aminotransferase (ALT) is rather imprecise. The results of repeated assays of a single specimen follow a normal distribution with mean equal to the ALT concentration for that specimen and standard deviation equal to 4 U/Li (as in Exercise 4.40). Suppose a hospital lab measures many specimens every day, and specimens with reported ALT values of 40 or more are flagged as “unusually high.” If a patient's true ALT concentration is 35 U/Li find the probability that his specimen will be flagged as “unusually high”

   a. if the reported value is the result of a single assay
   b. Find the 99th percentile of this distribution.
   c. if the reported value is the mean of three independent assays of the same specimen

2. The heights of men in a certain population follow a normal distribution with mean 69.7 inches and standard deviation 2.8 inches.

   a. If a man is chosen at random from the population, find the probability that he will be more than 72 inches tall.
   b. Find the 95th percentile of this distribution.
   c. If two men are chosen at random from the population, find the probability that their mean height will be more than 72 inches.
   d. If two men are chosen at random from the population, find the probability that both of them will be more than 72 inches tall.

3. The activity of a certain enzyme is measured by counting emissions from a radioactively labeled molecule. For a given tissue specimen, the counts in consecutive 10-second time periods may be regarded (approximately) as repeated independent observations from a normal distribution (as in Exercise 4.26). Suppose the mean 10-second count for a certain tissue specimen is 1,200 and the standard deviation is 35. For that specimen, let $Y$ represent a 10-second count and let $\bar{Y}$ represent the mean of six 10-second counts. Find $P\{1175 \leq Y \leq 1225\}$ and $P\{1175 \leq \bar{Y} \leq 1225\}$ and compare the two. Does the comparison indicate that counting for one minute and dividing by 6 would tend to give a more precise result than merely counting for a single 10-second time period? How?

4. Find the following critical points.
   a. $Z_{0.10}$
   b. $Z_{0.025}$
5. In a study of the fruitfly *Drosophila melanogaster*, a single experimental fly was observed for three minutes while in a chamber with ten other flies of the same sex. The observer recorded the timing of each episode ("bout") of preening by the experimental fly. The experiment was replicated 15 times with male flies and 15 times with female flies (different flies each time). The researcher would like to use a statistical test to evaluate the preening times for the females that requires the assumption the data come from a normal population. Use the QQplot to assess normality.

6. The following three normal probability plots, (a), (b), and (c), were generated from the distributions shown by histograms I, II, and III. Which normal probability plot goes with which histogram? How do you know?