5. When the population variance is known, we are able to compute how many subjects will be required for some particular degree of power.
6. An $X\%$ confidence interval is an interval around a sample mean that includes the population mean μ with probability $X/100$. The greater the power, the smaller are the confidence intervals around the sample means. The smaller the confidence intervals, the better the population means are isolated.

PROBLEMS

1. Use the data from Chapter 7, problem 4, to solve the following:
   a. Suppose the mean breaking strength is actually 59 pounds. What is the power of the test?
   b. Suppose the mean breaking strength is actually 50 pounds and a 0.15 significance level is used. What is the power of the test?
2. Use the information from Chapter 7, problem 3, to solve the following:
   a. Suppose that the mean weight of Texas sheriffs is actually 245 pounds. What is the power of the test?
   b. Suppose the mean weight of the Texas sheriffs is actually 230 pounds. What is the power of the test?
3. Use the data from Chapter 7, problem 6, to solve the following:
   a. Suppose the wax actually decreases flying time to 4.4 hours. What is the power of the test?
   b. Suppose the wax actually decreases flying time to 4.65 hours. What is the power of the test?
   c. Suppose the wax actually decreases flying time to 4.0 hours. What is the power of the test?
   d. Repeat parts a–c but assume that the test is based only on 50 flights.
   e. Repeat parts a–c but assume the test is based only on 10 flights.
   f. Use parts a–c, then d, then e to generate power curves.
4. Use the information from Chapter 7, problem 11, to solve the following:
   a. Suppose that, in terms of population means, Ultra-Brite is actually three points higher than Crest. What would the power of the test be (again, assume a 0.01 α-level)?
   b. Suppose that Ultra-Brite has a population mean that is eight points higher than that of Crest. What would the power of the test be?
5. A meteorologist hypothesizes that Portland receives more inches of rainfall per year than does Seattle. It is well known that inches of rainfall in both cities is distributed normally over years with a standard deviation $\sigma = 2$. Unfortunately, many of the meteorological records have been destroyed in a flood, and data can be found only for a sample of 6 years for Seattle and a sample of 10 years for Portland. (You may assume that these are random

samples, as it was a random flood.) From these data the meteorologist calculates that the mean rainfall for the 6 years in Seattle is $M_S = 14$ inches and the mean rainfall for the 10 years in Portland is $M_P = 15.5$ inches.

a. Test the hypothesis that Portland receives more rain than does Seattle.
b. Suppose that *in fact* Portland received an average of 2 inches more rain a year than does Seattle. What is the power of the test in question a?

6. Use the information from problem 12 in Chapter 7 to solve the following: Suppose that in reality, Miracugrow makes Merkin plants grow 3 inches taller than Amazofood. What is the power of the test you performed in the last chapter?

7. Heights of Martians are distributed with a mean $\mu = 3$ feet and a variance $\sigma^2 = 4$. A sample of $n = 4$ Martians is fed Rice Krispies from birth to see if the Rice Krispie diet will increase their heights above the population mean. Against what alternative hypothesis will the power of the resulting text be 0.90? Assume $\alpha = 0.05$.

8. A coin collector is looking for "Butte pennies." Butte pennies resulted from a slip-up in the minting process and are only detectable in that their probability of turning up tails is 0.60 rather than the usual 0.50. When the coin collector comes across a penny he suspects to be a Butte penny, he sets up the following hypotheses:

   H_0: The penny is a normal penny.
   H_1: The penny is a Butte penny.

   To evaluate these hypotheses, the collector will fip the penny some number of times and observe the number of tails.

   a. Describe what is meant by an α error and by power in this experiment.
   b. Suppose that the α-level is set a 0.10. How many flips will be required such that the power of the experiment is 0.95.
   c. Repeat part b assuming an α-level of 0.01.

9. An anthropologist knows that the volume of a human head is normally distributed with the following parameters: $\mu = 100$ cubic inches, $\sigma^2 = 150$.

   a. The anthropologist is interested in determining whether heads of Neanderthal man are distributed with a mean smaller than 100. How many Neanderthal heads would he have to test in order for his probability of successfully detecting a difference of 10 cubic inches or more to be 0.90 (assume on α-level of 0.05)?
   b. Recompute the number of heads needed using an α-level of 0.15.

10. It is known from census bureau records that females marry at an age that has a variance $\sigma^2 = 16$. Suppose a sociologist is interested in whether females from Seattle tend to marry at an *earlier* age than do females from Puyallup. Samples of 10 Seattle and 10 Puyallup females are selected and show the following means:

    Seattle: $M_S = 22.2$ years
    Puyallup: $M_P = 25.8$ years

a. Should the sociologist reject the hypothesis that Seattle and Puyallup females marry at the same age? Show all hypothesis-testing steps and *use the 0.10 α-level.*

b. Suppose that Seattle females actually marry at an age $\mu_S = 22$ years and Puyallup females actually marry at an age $\mu_p = 25$ years. What is the power of the test in question a?

c. Suppose the sociologist wants to ensure that the power of her test is 0.98 against the alternative hypothesis that Seattle females marry two years earlier than do Puyallup females. How many subjects would be in each sample (assume an equal number of subjects in each sample)?

11. Compute 50 and 95% confidence intervals around the means of Harvard and UW students in Chapter 7, problem 8.

12. Compute 80 and 99% confidence intervals around the Crest and Ultra-Brite means in Chapter 7, problem 11.

13. Suppose a poll of 100 randomly selected Americans indicates that 23 of them are smokers. What is the best estimate of the population mean proportion of Americans who smoke? What are the 90 and 95% confidence intervals around this estimate proportion?