Hypothesis Testing

1. A population distribution is known to have standard deviation 20. The average of a sample of 64 observations is 57.5. Test of the hypothesis that the population mean is equal to 50 against the alternative hypothesis $\mu \neq 50$ at the 0.01 level of significance.

2. The weights of salmon grown at a commercial hatchery are normally distributed with a standard deviation of 1.2 pounds. The hatchery claims that the mean weight of this year's crop is at least 7.6 pounds. Suppose a random sample of 16 fish yielded an average weight of 7.2 pounds. Is this strong enough evidence to reject the hatchery's claims at the 5 percent level of significance;

3. A random sample of 64 bags of white cheddar popcorn weighed, on average, 5.23 ounces with a standard deviation of 0.24 ounce. Test the hypothesis that $\mu = 5.5$ ounces against the alternative hypothesis, $\mu < 5.5$ ounces, at the 0.05 level of significance.

4. An advertisement for a new toothpaste claims that it reduces cavities of children in their cavity-prone years. Cavities per year for this age group are normal with mean 3 and standard deviation 1. A study of 2,500 children who used this toothpaste found an average of 2.95 cavities per child. Assume that the standard deviation of the number of cavities of a child using this new toothpaste remains equal to 1.

   (a) Are these data strong enough, at the 5 percent level of significance, to establish the claim of the toothpaste advertisement?

   (b) Do the data convince you to switch to this new toothpaste?

5. Past experience indicates that the time required for high school seniors to complete a standardized test is a normal random variable with a standard deviation of 6 minutes. Test the hypothesis that $\sigma = 6$ against the alternative that $\sigma < 6$ if a random sample of the test times of 20 high school seniors has a standard deviation $s = 4.51$. Use a 0.05 level of significance.

6. Past data indicate that the amount of money contributed by the working residents of a large city to a volunteer rescue squad is a normal random variable with a standard deviation of \$1.40. It has been suggested that the contributions to the rescue squad from just the employees of the sanitation department are much more variable. If the contributions of a random sample of 12 employees from the sanitation department have a standard deviation of \$1.75, can we conclude at the 0.01 level of significance that the standard deviation of the contributions of all sanitation workers is greater than that of all workers living in the city?

7. A sample of 10 fish were caught at lake A and their PCB concentrations were measured using a certain technique. The resulting data in parts per million were
   Lake A: 11.5, 10.8, 11.6, 9.4, 12.4, 11.4, 12.2, 11, 10.6, 10.8
   In addition, a sample of 8 fish were caught at lake B and their levels of PCB were measured by a different technique than that used at lake A. The resultant data were
   Lake B: 11.8, 12.6, 12.2, 12.5, 11.7, 12.1, 10.4, 12.6
   If it is known that the measuring technique used at lake A has a variance of .09 whereas the one used at lake B has a variance of .16, could you reject (at the 5 percent level of significance) a claim that the two lakes are equally contaminated?

8. A professor claims that the average starting salary of industrial engineering graduating seniors is greater than that of civil engineering graduates. To study this claim, samples of 16 industrial engineers and 16 civil engineers, all of whom graduated in 1993, were chosen and sample members were queried about their starting salaries. If the industrial engineers had a sample mean salary of \$47,700 and the civil engineers had a sample mean salary of \$46,400 , has the professor's claim been verified?

   Suppose that the salaries of the industrial engineers is normally distributed with standard deviation of \$2,400 and the salaries of the civil engineers is normally distributed with standard deviation of \$2,200