Parameters Estimation

August 10, 2022

1. An electric scale gives a reading equal to the true weight plus a random error that is normally distributed with mean 0 and standard deviation $\sigma = .1$ mg. Suppose that the results of five successive weighings of the same object are as follows: 3.142, 3.163, 3.155, 3.150, 3.141.

   (a) Determine a 95 percent confidence interval estimate of the true weight.

   (b) Determine a 99 percent confidence interval estimate of the true weight

2. The standard deviation of test scores on a certain achievement test is 11.3. If a random sample of 81 students had a sample mean score of 74.6, find a 90 percent confidence interval estimate for the average score of all students.

3. Many cardiac patients wear an implanted pace- maker to control their heartbeat. A plastic connector module mounts on the top of the pacemaker. Assuming a standard deviation of 0.0015 inch and an approximately normal distribution. How large a sample is needed if we wish to be 95% confident that our sample mean will be within 0.0005 inch of the true mean?

4. A random sample of the birth weights of 186 babies has a mean of 3103 g and a standard deviation of 696 g. Construct a 95% confidence interval estimate of the mean birth weight for all such babies, assuming an approximately normal distribution.

5. A machine produces metal pieces that are cylindrical in shape. A sample of pieces is taken, and the diameters are found to be 1.01, 0.97, 1.03, 1.04, 0.99, 0.98, 0.99, 1.01, and 1.03 centimeters. Find a 99% confidence interval for the mean diameter of pieces from this machine, assuming an approximately normal distribution.

6. In a random sample of 1000 homes in a certain city, it is found that 228 are heated by oil.

   (a) Find 99% confidence intervals for the proportion of homes in this city that are heated by oil.

   (b) How large a sample is needed if we wish to be 99% confident that our sample proportion will be within 0.05 of the true proportion of homes in the city that are heated by oil?

7. A random sample of 20 students yielded a mean of $\bar{x} = 72$ and a variance of $s^2 = 16$ for scores on a college placement test in mathematics. Assuming the scores to be normally distributed, construct a 98% confidence interval for σ^2.

8. The capacities (in ampere-hours) of 10 batteries were recorded as follows: 140, 136, 150, 144, 148, 152, 138, 141, 143, 151

   (a) Give a point estimate for the population variance σ^2.

   (b) Compute a 99 percent two-sided confidence interval for σ^2