

Sample Size Determination and Confidence Interval Estimation for the Population Variance

1. The lengths of metal rods produced by an industrial process are normally distributed with a standard deviation of 1.8 millimeters. Based on a random sample of nine observations from this population, the 99% confidence interval $194.65 < \mu < 197.75$ for the population mean length. Suppose that a production manager believes that the interval is too wide for practical use and instead requires a 99% confidence interval extending no further than 0.50 mm on each side of the sample mean. How large a sample is needed to achieve such an interval? (Source: Statistics for Business and Economics, 2007, 6th edition, Prentice Hall, by Paul Newbold, William L. Carlson, Betty Thorne. pp.323)
2. A research group wants to estimate the proportion of consumers who plan to buy a scanner for their PC during the next three months. (pp.325)
 - a. How many people should be sampled so that the sampling error is at most 0.04 with a 90% confidence interval?
 - b. What is the sample size required if the confidence is increased to 95%, keeping the sampling error the same?
 - c. What is the required sample size if the research group extends the sampling error to 0.05 and wants a 98% confidence level?
3. In last week's tutorial based on 142 graduate admissions personnel we estimated the 95% confidence interval $0.533 < P < 0.693$ for the population proportion of graduate admissions personnel with the view of "very important" on the role of the scores on standardized tests. Suppose, instead, that it must be ensured that a 95% confidence interval for the population proportion extends no further than 0.06 on each side of the sample proportion. How large a sample must be taken? (pp.324)
4. Suppose that an opinion survey following a presidential election reported the views of a sample of US citizens of voting age concerning changing the electoral college process. The poll was said to have a 3% margin of error. The implication is that a 95% confidence interval for the population proportion holding a particular opinion is the sample proportion plus or minus at most 3%. How many citizens of voting age need to be sampled to obtain this 3% margin of error?(pp.325)
5. Several drugs are used to treat diabetes. A sales specialist for a leading pharmaceutical company randomly sampled the records of 10 sales districts to estimate the number of new prescriptions that had been written during a particular month for his company's new diabetes drug. The numbers of new prescriptions were
210 240 190 275 290 265 312 284 261 243
 - a. Find a 90% confidence interval for the average number of new prescriptions written for this new drug among all the sales districts. What are the assumptions?
 - b. Assuming that the confidence level remains constant, what sample size is needed to reduce by half the margin of error of the confidence interval in part (a)?
6. A clinic offers a weight-reduction program. A review of its records found the following weight losses in pounds, for a random sample of 10 clients at the conclusion of the program: (pp.321)
18.2 25.9 6.3 11.8 15.4 20.3 16.8 19.5 12.3 17.2
Find a 90% confidence interval for the population variance of weight losses for clients of this weight-reduction program.
7. The quality control manager of a chemical company randomly sampled twenty 100-pound bags of fertilizer to estimate the variance in the pounds of impurities. The sample variance was found to be 6.62. Find a 95% confidence interval for the population variance in the pounds of impurities. (pp.321)
8. A manufacturer is concerned about the variability of the levels of impurity contained in consignments (sevkiyat-konsiye satış) of raw material from a supplier. A random sample of 15 consignments showed a standard deviation of 2.36 in the concentration of impurity levels. Assume normality. (pp.321)
 - a. Find a 95% confidence interval for the population variance.
 - b. Would a 99% confidence interval for this variance be wider or narrower than that found in part (a)?
9. A manufacturer bonds a plastic coating to a metal surface. A random sample of 9 observations on the thickness of this coating is taken from a week's output, and the thickness (in millimeters) of these observations are as follows: (pp.321)
19.8 21.2 18.6 20.4 21.6 19.8 19.9 20.3 20.8
Assuming normality, find a 90% confidence interval for the population variance.
10. The manager of Northern Steel, Inc., wants to assess the temperature variation in the firm's new electric furnace. A random sample of 25 temperatures over a 1-week period is obtained, and the sample variance is found to be $s^2=100$. Find a 95% confidence interval for the population temperature. (pp.320)