CE2100/CZ2100
Probability and Statistics for Computing

Tutorial 2 - Large-Sample Estimation

Problem 1

An increase in the rate of consumer savings is frequently tied to a lack of confidence in the economy. A random sample of $n = 200$ savings accounts in a local community showed a mean increase in savings account values of 7.2% over the past 12 months, with a standard deviation of 5.6%. Estimate the mean percentage increase in savings account values over the past 12 months for depositors in the community. Find the margin of error for your estimate.

Problem 2

An opinion poll indicated that 49% of the 1034 adults surveyed think that country A should pursue a program to send humans to Mars. Estimate the true proportion of people who think that country A should pursue this program. Calculate the margin of error.

Problem 3

Each of $n = 30$ students in a chemistry class measured the amount of copper precipitated from a saturated solution of copper sulfate over a 30-minute period. The sample mean and standard deviation of the 30 measurements were equal to 0.145 and 0.0051 mole, respectively. Find a 90% confidence interval for the mean amount of copper precipitated from the solution over a 30-minute period.

Problem 4

A survey is designed to estimate the proportion of sports utility vehicles (SUVs) being driven in the state of California. A random sample of 500 registrations is selected from a Department of Motor Vehicles database, and 68 are classified as SUVs. Use a 95% confidence interval to estimate the proportion of SUVs in California.

Problem 5

It is reported that, in a study of a particular wafer inspection process, 356 dies were examined by an inspection probe and 201 of these passed the probe. Assuming a stable process, calculate a 95% (two-sided) confidence interval for the proportion of all dies that pass the probe.

Problem 6

For a study, we conduct on nutrition and access to fresh produce in Beaufort County, North Carolina. We want to know how much an adult spends on locally-produced fruit and vegetables in June. We randomly select 100 individuals from the county property records and send a survey to those residents about their eating, shopping and gardening practices. With our sample, we find that the average amount an adult spends on locally-grown fruits and vegetables in June is $40.00. We know from previous studies that the standard deviation of money spent on local produce is $10. Construct a 95% confidence interval for the mean (per capita) amount spent on fresh, local produce.

Additional Questions (Do not discuss in tutorial)

Problem 7

It is reported that for a sample of 50 kitchens with gas cooking appliances monitored during a one-week period, the sample mean of CO_2 level (ppm) was 654.16, and the sample standard deviation was 164.43.

(a) Calculate the 95% (two-sided) confidence interval for the true average CO_2 level in the population of all homes from which the sample was selected.

(b) Suppose the investigators had made a rough guess of 175 for the value of standard deviation s before collecting data. What sample size would be necessary to obtain an interval width of 50 ppm for a confidence level of 95%?

Problem 8

Let $X_1, \ldots, X_n$ be a random sample from population with mean μ and variance σ^2. Show that the sample variance $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is an unbiased estimator for σ^2.