

Chapter II

Estimation Theory

Exercises

Part I:

1.

The Annual salary for public school teachers in the US is \$32000. The mean salary for a sample of 750 school teachers equals 31895. Identify the population, the population mean, and the sample mean. Identify the parameter and the point estimate of the parameter.

2.

Ninety-eight percent of homes in a certain city have a TV. A survey of 2000 homes finds that 1925 have a TV. Identify the population, the population proportion, and the sample proportion. Identify the parameter and point estimate of the parameter.

3.

For a data set obtained from a sample of 20 items and the mean 24.5, it is known that the population is normally distributed with a standard deviation of 3.1.

1. What is the point estimate of the population?
2. Make a 99% confidence interval for the mean of the population.

4.

A sample of 1500 homes sold recently in a town gave the mean price of 269720 €. The population standard deviation was 68650 €. Construct a 99% confidence interval for the mean price of homes in this town

5.

A bank manager has developed a new system to reduce the time customers spend waiting to be served by tellers during peak business hours. Typical waiting times during peak business hours under the current system are roughly 9-10 minutes. The bank manager hopes that the new system will lower typical waiting times to less than six minutes. A 30-day trial of the new system is

conducted. During the trial run, every 150th customer who arrives during peak business hours is selected until a systemic sample of 100 customers is obtained. Each of the sampled customers is observed, and the time spent waiting for teller service is recorded. Moreover, the bank manager feels that this systemic sample is as representative as a random sample of waiting times would be. The mean of the sample of 100 customers waiting times is 5.46. Assuming a standard deviation of 2.47 minutes for all customers,

1. Calculate 95% and 99% confidence intervals for the mean of the waiting time of all customers during the peak hours,
2. Using the 95% confidence interval, can the bank manager be 95% confident that the mean is less than 6 minutes?
3. Using the 99% confidence interval, can the bank manager be 99% confident that the mean is less than 6 minutes?
4. Based on your answers to the questions in parts 1 and 2, how convinced are you that the new mean waiting time is less than 6 minutes?

6.

Referring to Exercise 2.5., assume that the standard deviation of waiting times of all customers is unknown. However, the corresponding value for the sample of 100 customers is equal to 2.475.

Calculate a 95% confidence interval for the mean of all possible bank customers waiting times using the new system. Are we 95% confident that this mean is less than six minutes?

7.

A marketing research analyst collects data for a random sample of 100 customers out of the 4000 who purchased a particular “coupon special”. The 100 people spent an average of 24.57 € in the store with a standard deviation of 6.60 €. Using a 95 percent confidence interval, estimate

1. the mean purchase amount for all 4000 customers
2. the total euro amount of purchases by the 4000 customers.

8.

A prospective purchaser wishes to estimate the mean Euro amount of sales per customer at a toy store at an airline terminal. Based on data from other similar airports, the standard deviation of such sales amounts is estimated to be about 3.20 €.

What size of random sample should be collected, as a minimum, if the purchaser wants to estimate the mean sales amount within 1.00 € and with 99% percent confidence?

9.

Referring to Exercise 2.8., what is the minimum required sample size if the distribution of sales amount is not assumed to be normal and the purchaser wishes to estimate the mean sales amount within 2.00 € with 99 percent confidence?

10.

A company that manufactures exercising machines wanted to know the percentage of apartments in a community that provide on-site health care and exercise facilities.

A sample survey of 119 such apartments showed that 75 of these apartments provide such facilities.

1. What is the point estimate of the percentage of all such apartments that provide such facilities?
2. Assuming a 95% confidence level, what is the bound on error associated with this point estimate?
3. Find a 95% confidence interval for the percentage of all such apartments that provide such facilities?

11.

A major newspaper selected a simple random sample of 1600 readers from their list of 100000 subscribers. They asked whether the paper should increase its coverage of local news. Forty percent of the sample wanted more local news. What is the 99% confidence interval for the proportion of readers who would like more coverage of local news?

12.

An electronics company has just installed a new machine that makes a part that is used in

computers. The company wants to estimate the proportion of these parts produced by this machine that are defective. The company manager wants this estimate to be within 0.02 of the population proportion for a 95% confidence level.

What is the most conservative estimate of the sample size that will limit the maximum error to within 0.02 of the population proportion?

Part II: SPSS

1.

Data Set: *Csernely_data.sav*

Define a 95% confidence interval for the *total expenditure*

(Last updated: 04.12.19)