

Revision Tutorial Topic 6

Confidence Intervals

Introduction

In this topic we will be looking at the purpose of a Confidence Interval and how to create and interpret them.

We calculate a Confidence Interval by putting what's called a margin of error either side of my **sample** mean average. I do this because my sample mean average is what's called a point estimate and point estimates are invariably wrong because of sampling error. Hopefully, after I construct this Confidence Interval the **true** population mean is somewhere within the interval.

Therefore, the aims of this tutorial are to:

- calculate estimates and their standard errors
- calculate and interpret Confidence Intervals for a population mean (numeric data)
- calculate and interpret Confidence Intervals for a population proportion (categorical data)
- determine the sample size necessary to develop a confidence interval for the mean or proportion

Textbook Questions

- 8.8 The quality control manager at a light globe factory needs to estimate the mean life of a large shipment of energy-saving light-emitting diode (LED) light globes. The standard deviation is 3,000 hours. A random sample of 64 light globes indicates a sample mean life of 34,000 hours.
- Construct a 95% confidence interval estimate of the population mean life of light globes in this shipment.
 - Do you think that the manufacturer has the right to state that the light globes last an average of 35,000 hours? Explain.
 - Must you assume that the population of light globe life is normally distributed? Explain.
 - Suppose that the standard deviation changes to 6,000 hours. What are your answers in (a) and (b)?
- 8.16 Water resources in many parts of Australia are being closely watched and restrictions or water-wise rules have been imposed on activities such as garden watering. Suppose that Sydney Water monitors water usage in a suburb and finds that for one summer the average household usage is 408 litres per day. A year later it examines records of a sample of 50 households and finds that there is a daily mean usage of 380 litres with a standard deviation of 25 litres.
- Construct a 95% confidence interval for the population mean daily water usage in the second summer. Assume the population usage is normally distributed.
 - Interpret the interval constructed in (a).
 - Do you think water usage has changed in the second summer? Explain.
- 8.30 Suppose that, in a survey of 600 employers, 126 indicate that they have used a recruitment service within the past two months to find new staff.
- Construct a 95% confidence interval for the population proportion of employers who have used a recruitment service within the past two months to find new staff.
 - Construct a 99% confidence interval for the population proportion of employers who have used a recruitment service within the past two months to find new staff.

- c. Interpret the intervals in (a) and (b).
- d. Discuss the effect on the confidence interval estimate when you change the level of confidence.

8.70 The branch manager of an outlet (store 1) of a nationwide chain of pet supply stores wants to study the characteristics of her customers. In particular, she decides to focus on two variables: the amount of money spent by customers and whether the customers own only one dog, only one cat, or more than one dog and/or cat. The results from a sample of 70 customers are shown below:

- amount of money spent: $\bar{X} = \$21.34$, $S = \$9.22$
 - 37 customers own only a dog
 - 26 customers own only a cat
 - 7 customers own more than one dog and/or cat
- a. Construct a 95% confidence interval estimate of the population mean amount spent in the pet supply store.
 - b. Construct a 90% confidence interval estimate of the population proportion of customers who own only a cat.

The branch manager of another outlet (store 2) wishes to conduct a similar survey in his store. The manager does not have any access to the information generated by the manager of store 1.

- c. What sample size is needed to have 95% confidence of estimating the population mean amount spent in his store to within $\pm \$1.50$ if the standard deviation is \$10?
- d. What sample size is needed to have 90% confidence of estimating the population proportion of customers who own only a cat to within ± 0.045 ?
- e. Based on your answers to (c) and (d), how large a sample should the manager take?

TEXTBOOK REFERENCE:

Basic Business Statistics: Concepts and Applications. *Berenson, M.L. Levine, D.M. Szabat, K.A. O'Brien, M. Jayne, N. Watson, J.* 5th edition. 2019. Pearson Australia Group Pty Ltd. ISBN 9781488617249. Chapter 8, sections 8 to 8.4 and 8.6