

Quantitative Techniques:

Laboratory 7

10 November 2005

Overview

In this lab your tasks are

1. construct confidence intervals for the population proportion;
2. test hypotheses for the sample mean:
 - a. when σ is known (or the sample size is large: $n \geq 30$);
 - b. when σ is unknown;
3. test hypotheses about the difference between two means (independent samples; sample size is large: $n \geq 30$).

Task 1 – Confidence interval for the population proportion

[Black and Eldridge, Business and economic statistics using Microsoft Excel, demonstration problem 8.5, page 270]

A jeans company produces men's jeans. The jeans are made with either a regular cut or a boot cut. In order to estimate the proportion of their men's jeans market that is for boot-cut jeans, the company takes a random sample of 212 jeans sales. Only 34 of the sales were for boot-cut jeans.

Compute a 90% confidence interval to estimate the proportion of the population who prefer boot-cut jeans

1. In a new spreadsheet, type the available information from the problem.
2. Reminder from lecture:

$$P\left(\frac{\hat{\pi} - z_{1-\alpha/2}\sqrt{\frac{\hat{\pi}(1-\hat{\pi})}{n}} \leq \pi \leq \frac{\hat{\pi} + z_{1-\alpha/2}\sqrt{\frac{\hat{\pi}(1-\hat{\pi})}{n}}}{n}\right) = 1 - \alpha$$

3. For this task, you will need to find the z from the normal distribution which corresponds to a 90% level of confidence, using NORMSINV.
Reminder: this function requires the cumulative probability as an argument, i.e. if $1-\alpha$ is the level of confidence, you need the value of z which corresponds to $(1-\alpha/2)$.
4. Using the value of $z_{(1-\alpha/2)}$, compute the confidence interval.

Task 2a – Test hypothesis for the mean - σ known or n large

[Black and Eldridge, Business and economic statistics using Microsoft Excel, problem 9.3, page 303]

According to a survey, the average phone user earns \$62,000 a year. Suppose a business analyst believes that the average annual earnings of a mobile phone user are higher than that now, and he set up a study in an attempt to prove his theory. He randomly samples 48 mobile users and finds out that the average annual salary for this sample is \$64,820, with a standard deviation of \$7,810. Use $\alpha=0.01$ to test the business analyst's theory.

1. Type the available information from the problem.
2. Calculate the test statistic

3. Reminder from lecture

$$\frac{\bar{X} - a}{\frac{s}{\sqrt{n}}}$$
, where a is the assumed value of the mean.

- You need to find the z from the normal distribution which corresponds to a 99% level of confidence, using NORMSINV. Note that this is a one-tailed test.
Reminder: this function requires the cumulative probability as an argument, i.e. if $1-\alpha$ is the level of confidence, you need the value of z which corresponds to $(1-\alpha)$.
- Compare the test statistic you obtained from the sample with the value from the normal distribution and conclude whether you reject the hypothesis.

Task 2b – Test hypothesis for the mean - σ unknown, n small, normal distribution

[Black and Eldridge, Business and economic statistics using Microsoft Excel, Paragraph 9.3, page 304]

Assume you want to test the hypothesis that $\mu = 25$ pounds versus the hypothesis that $\mu \neq 25$. You randomly draw a sample of 20 individuals from the population and obtain $\bar{X} = 25.51$ and $S = 2.1933$.

- Type the available information from the problem.
- Calculate the test statistic.
- You will need to find the t from the Student distribution which corresponds to a $(1-\alpha)$ level of confidence using TINV. Note that, unlike NORMSINV, this Excel function requires the total probability on the two tails, i.e. α . Also, you need to specify the number of degrees of freedom, i.e. the sample size minus 1.
- Compare the test statistic you obtained from the sample with the value from the student distribution and conclude whether you reject the hypothesis.

Task 3 – Test hypothesis about the difference of means

[Black and Eldridge, Business and economic statistics using Microsoft Excel, demonstration problem 10.1, page 330]

Assume that a researcher runs a survey on two independent samples and obtains the following information regarding the amount paid into a private pension fund per person.

Sample	Women	Men
Sample mean	3343	5568
Sample standard deviation	1226	1716
Number	87	76

- Calculate the test statistic.
Reminder from the lectures

$$Z = \frac{(\bar{W} - \bar{M}) - (\mu_{\bar{W}} - \mu_{\bar{M}})}{\sqrt{\frac{S_W^2}{n_W} + \frac{S_M^2}{n_M}}}$$

2. You need to find the z from the normal distribution which corresponds to $\alpha = 0.001$, using `NORMSINV`. Note that this is a one-tailed test. Reminder: this function requires the cumulative probability as an argument.
3. Compare the test statistic you obtained from the sample with the value from the normal distribution and conclude whether you reject the hypothesis.