

Chapter 16. Inference in Practice

Where Did the Data Come From?

Note. When you use statistical inference, you are acting as if your data are a probability sample of come from a randomized experiment. Statistical confidence intervals and tests cannot remedy basic flaws in producing the data, such as voluntary response samples or uncontrolled experiments.

Cautions About the z Procedures

Note. The text again mentions the “simple conditions” for the z confidence interval and test:

- The data must be a SRS from the population.
- Outliers can distort the result.
- The shape of the population distribution matters—initially we assumed a normally distributed population. However, we have seen that the Central Limit Theorem insures that the sampling distribution for \bar{x} will be nearly normally distributed, especially for large sample sizes.

- You must know the standard deviation σ of the population—we will see how to liberate ourselves from this restriction in Chapter 18 when we encounter the t -distribution.

Example. Exercise 16.2 page 391.

Cautions About Confidence Intervals

Note. The margin of error in a confidence interval covers only random sampling errors. Practical difficulties such as undercoverage and nonresponse are often more serious than random sampling error. The margin of error does not take such difficulties into account.

Cautions About Significance Tests

Note. Because large random samples have small chance variation, very small population effects can be highly significant if the sample is large. Because small random samples have a lot of chance variation, even large population effects can fail to be significant if the sample is small. Statistical significance does not tell us whether an effect is large enough to be important. That is **statistical significance is not the same thing as practical significance.**

Example. Exercise 16.6, pages 394 and 395.

Partial Solution. We can use Minitab to give the needed P -values. Click on the **Stat** tab, select **Basic Statistics**, and **1-Sample Z...** In the pop-up window, select **Summarized data**, enter the **Sample size** (first 5, then 15, and then 40), **Mean** (4.8), **Standard deviation** (0.5), and **Test mean** (5). You are interested in $H_0 : \mu < 5.0$, so click on the **Options** tab and in the **Alternative** pull-down menu, select **less than**. Click **OK** twice and the results will be displayed. We get: (1) for $n = 5$, $p = 0.186$, (2) for $n = 15$, $p = 0.061$, and (3) for $n = 40$, $p = 0.006$. Notice that Minitab also gives a 95% confidence interval (or other confidence intervals if you modify the input under **Options**).

Type I and Type II Errors

Definition. If we reject H_0 when in fact H_0 is true, this is a **Type I error**. If we fail to reject H_0 when in fact H_a is true, this is a **Type II error**. The **significance level** α of any fixed level test is the probability of a Type I error. The **power** of a test against any alternative is 1 minus the probability of a Type II error for that alternative.

Note. A graphical representation of Type I and Type II errors is:

	H_0 true	H_a true
Reject H_0	Type I error	Correct Decision
Fail to Reject H_0	Correct Decision	Type II Error

Example. Example 16.6, pages 401 and 402.

Note. The *Power of a Test* applet draws a picture like the following:

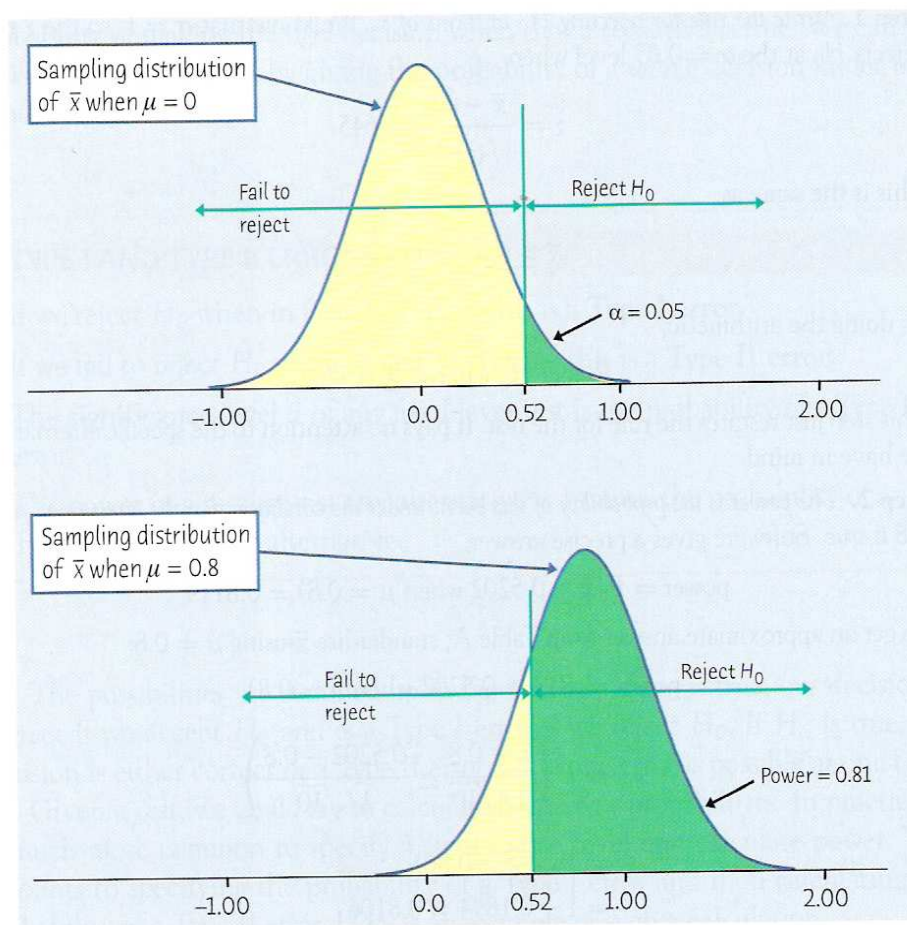


Figure 16.2, Page 402

Example. Exercise 16.15, page 403. This exercises uses the common “false positive” and “false negative” terminology.

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