The lesson documents provide information about using the calculator provided with the lessons. The purpose of this supplement is to supply information about another possible technology, namely the StatCrunch computer software product.

CAUTION: You should note that the interface for StatCrunch has changed in the past and may well change in the future – accordingly, some of the information given here may prove to be out of date.

Starting StatCrunch – see Lesson 2 document

Lesson 11

Just as we learned in Lesson 9 for proportions, it is possible to use technology to carry out the calculations for you. To illustrate the process, we will use two examples we have already solved "by hand" in Sections 11.1 and 11.2.

Note: The key to determining the appropriate menu option is remembering these three things:

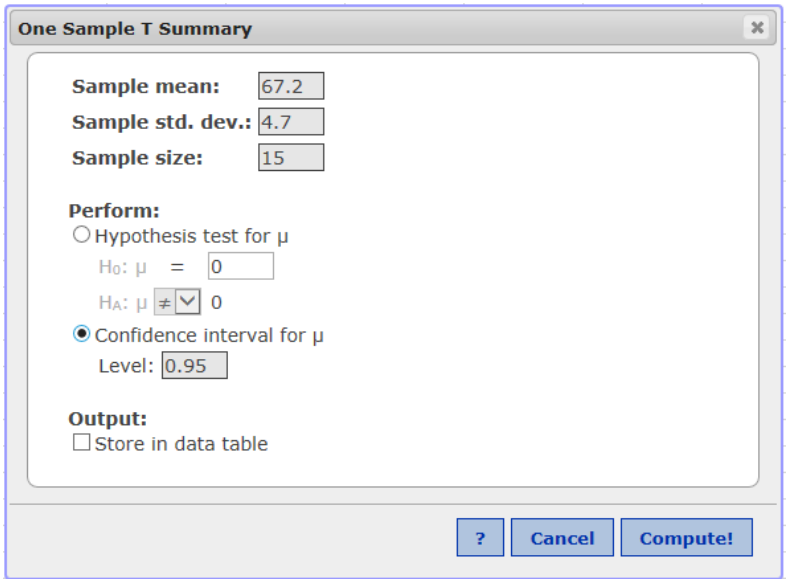
- We have a single sample.
- We are working with means rather than proportions.
- The calculations are based on a *t* distribution.

Of course, one additional ingredient is knowing whether you are doing a hypothesis test or a confidence interval. We use a confidence interval to *estimate* the value for the population mean, and a hypothesis test to *examine/test a claim* about the population mean.

Using StatCrunch for confidence intervals

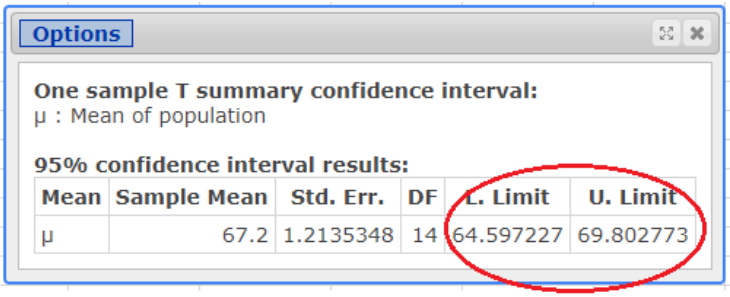
Example. Suppose we take a sample of size 15 and obtain a mean of 67.2, with a standard deviation of 4.7, for the variable we are measuring. Find a 95% confidence interval for the population mean.

1. Just as for the hypothesis test, use menu option **Stat > T Stats > One Sample > With Summary**. On the resulting screen, enter the data, choose the **Confidence Interval** option, and set the confidence level as shown below.



Caution: Use the T Stats option; do not use the Z Stats option. As discussed in Section 11.3, using Z (the normal distribution) would be appropriate only if you knew the standard deviation for the entire population, which is extremely unlikely.

2. Click **Compute!**, obtaining these results:

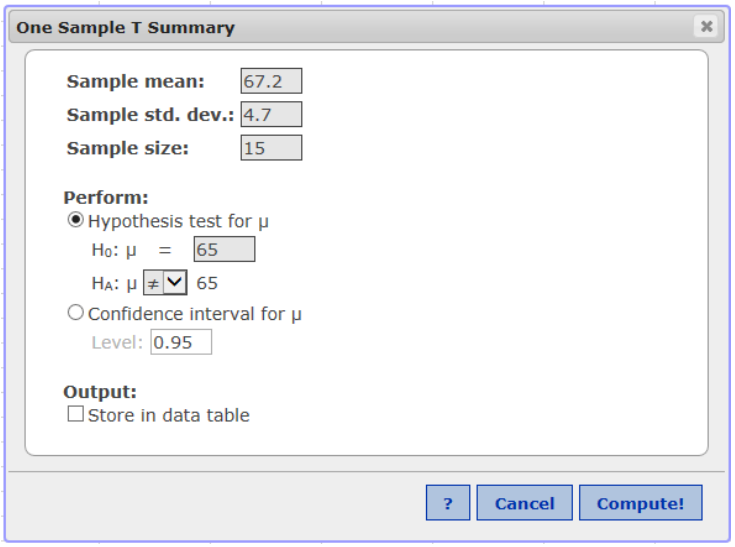


3. In interval notation, rounded to the nearest tenth, the confidence interval is (64.6, 69.8).

Using StatCrunch for hypothesis tests

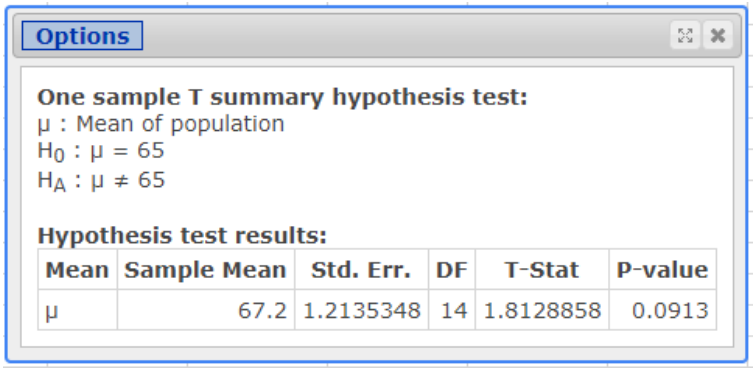
Example. Carry out a two tail test to investigate the claim that the population mean is 65. We take a sample of size 15 and obtain a mean of 67.2, with a standard deviation of 4.7, for the variable we are measuring.

1. Use menu option **Stat > T Stats > One Sample > With Summary.** On the resulting screen, enter the data, choose hypothesis test, fill in the μ_0 value from the null hypothesis, and indicate the form of the alternative hypothesis (≠, >, or <), as shown here.



Caution: Use the T Stats option; do not use the Z Stats option. As discussed in Section 11.3, using Z (the normal distribution) would be appropriate only if you knew the standard deviation for the entire population, which is extremely unlikely.

2. Click **Compute!**, obtaining these results:



The *t* test statistic is 1.8129, with a p-value of 0.0913. We do not reject the null hypothesis.

What if I have actual data?

In both these examples, we have been given summary data (sample mean, sample standard deviation, and sample size. What would we do differently given a set of data instead of the summary information? There are two approaches. One is to use the methods developed in Lesson 2, pages 10-13, to enter the data into a column in StatCrunch, then to calculate the summary statistics for that column. We can then use StatCrunch as outlined in the two previous examples, by entering those summary statistics as described in the examples.

Another approach, similar for both the confidence interval and the hypothesis test, also involves putting the data into a column. Then, when we choose the "Stat" > "T Statistics" > "One sample" menu option, we choose > "with data" rather than "with summary." In the resulting pop-up window, we simply choose the column we placed the data in (perhaps "var1") and click on "Next." From this point on the steps are the same as those outlined in the examples above.

Additional information for the "by hand" section

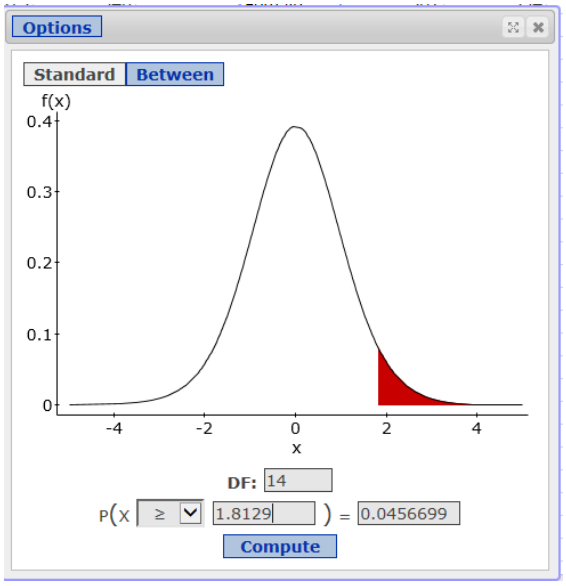
Example. To illustrate the mechanics of the calculations, we will carry out a two tail test to investigate the claim that the population mean is 65. We take a sample of size 15 and obtain a mean of 67.2, with a standard deviation of 4.7, for the variable we are measuring. Here are the steps:

1. $H_0: \mu = 65$
   $H_a: \mu \neq 65$

2. $se = \frac{s}{\sqrt{n}} = \frac{4.7}{\sqrt{15}} = 1.2135$

3. $t = \frac{67.2-65}{1.2135} = 1.8129$

4. Because *n* is 15, we use $df = n - 1 = 14$ when we calculate the *p*-value. Using StatCrunch's **Stat > Calculators > T** menu option, we enter our *t*-score and *df* as shown here and press the **Compute** button to obtain these results:



The result is the one-tail *p*-value, we must remember to double it to obtain 0.0913.

Solutions to exercise that use technology

Exercise 7. Calculate a 99% confidence interval for a population mean for each situation described. Round your final answer to the nearest whole number. For each situation, is it plausible that the population mean is 450?

a. sample size 28, mean for the sample is 497, standard deviation for the sample is 93

The menu option is **Stat > T Stats > One Sample > With Summary.** On the resulting screen, choose the confidence interval option, and enter the following:

Sample mean:	497
Sample std. dev.:	93
Sample size:	28
Level:	0.99

Click *Compute!* The results include the following:

L.Limit	448.30428
U.Limit	545.69572

Rounded to the nearest whole number, the confidence interval is (448,546). It is plausible that the population mean is 450.

b. sample size 55, mean for the sample is 497, standard deviation for the sample is 93

Same menu choices as part (a), enter this:

Sample mean:	497
Sample std. dev.:	93
Sample size:	55
Level:	0.99

Click *Compute!* The results include the following:

L.Limit	463.51808
U.Limit	530.48192

Rounded to the nearest whole number, the confidence interval is (464,530). It is not plausible that the population mean is 450.

Exercise 8. Carry out a left-tail test to examine the claim that the population mean is 514, given that your sample of size 56 has a sample mean of 490 with a standard deviation of 98.

The menu option is **Stat > T Stats > One Sample > With Summary.** On the resulting screen, choose the hypothesis test option, and enter the following:

Sample mean: 490
Sample std. dev.: 98
Sample size: 56
$H_0: \mu = 514$
$H_a: \mu < 514$

Click *Compute!* The results include the following:

T-Stat -1.8326485
P-value 0.0361

Rounded to four places, the test statistic is $t = -1.8326$ with *p*-value 0.0361.