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 TI-83/84 series calculator.

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in the past and may well change in the future – accordingly, some of the information given here may prove to be out of date.

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 the TI calculator 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. Go to STAT and right arrow over to TESTS.

2. Scroll down to the page with options for confidence intervals, and choose the ***TInterval*** option, then hit enter. (The "Interval" indicates that you are doing a confidence interval, and the "T" that the calculations are based on a *t* distribution.)

Caution: do not use the *ZInterval* 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.

3. Just as for hypothesis tests, the first step is to choose "Stats" on the second line of the resulting screen:

TInterval
Inpt: Data Stats

4. Enter the statistics as shown, scroll down to Calculate, and press enter.:

TInterval
Inpt: Data Stats
$\bar{x}$: 67.2
Sx: 4.7
n: 15
C-level: .95
Calculate

5. The results are shown as follows:

TInterval
(64.597,69.803)
$\bar{x}$ = 67.2
Sx = 4.7
n = 15

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

Using the TI calculator 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. Go to STAT and right arrow over to TESTS.

2. The first page has options for hypothesis tests. Choose the ***T-Test*** option, then hit enter. (The "Test" indicates that you are doing a hypothesis test, and the "T" that the calculations are based on a *t* distribution.)

Caution: do not use the *Z-Test* 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.

3. The first two lines of the resulting screen look like this.

TInterval
Inpt: Data Stats

You choose "Data" if you have entered actual data into one of the lists (L1, L2, etc.), and "Stats" if you will be entering summary statistics. Choose "Stats".

4. Enter the information as shown, scroll down to Calculate, and press enter. Remember that μ_0 is the symbol for the mean in the null hypothesis, and $\bar{x}$ indicates the sample mean. On the next to last line, we choose the $\neq \mu_0$ option because that is the form of the alternative hypothesis (we are doing a two-tail test). Scroll down to Calculate and press Enter.

T-Test
Inpt: Data Stats
μ0:65
$\bar{x}$: 67.2
Sx: 4.7
n: 15
μ:≠μ0 <μ0 >μ0
Calculate Draw

5. The results are shown as follows:

T-Test
$\mu \neq 65$
t=1.812885822
p=.091342079
$\bar{x}$ = 67.2
Sx = 4.7
n = 15

6. 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 7-10, to enter the data into a list, then to calculate the summary statistics for that list. We can then use the calculator 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 list. Then, when we choose the TInterval or T-Test option on the calculator, we choose Data rather than Stats on the second line of the screen, as shown on the left for hypothesis tests and on the right for confidence intervals:

T-Test	TInterval
Inpt: Data Stats	Inpt: Data Stats

This results in the screens shown here.

T-Test	TInterval
Inpt: Data Stats	Inpt: Data Stats
$\mu 0$:65	List: L1
List: L1	Freq: 1
Freq: 1	C-level: .95
μ:$\neq \mu 0$ $< \mu 0$ $> \mu 0$	Calculate
Calculate Draw	

We simply tell the calculator which list contains the data (L1 in the examples above), and enter the necessary information (C-level for a confidence interval, and information about the null and alternative hypothesis for the hypothesis test).

(For purposes of this course, the "Freq" will always be left as 1. In more complicated situations, a second list might contain frequencies for each data item in the first list; if so, Freq would indicate that second list.)

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 tje calculator's 2nd DISTR menu, we enter **2*tcdf(1.8129, 10000, 14)** and obtain a *p*-value of 0.0913. (We use $2 * tcdf$ rather than just *tcdf* because it is a two-tail test.)

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 TEST, option ***TInterval***. Then choose *Stats*, and enter the following information:

$\bar{x}$: 497
Sx: 93
n: 28
C-Level: .99

Use the *Calculate* option. The results include the following:

(448.3,545.7)

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:

$\bar{x}$: 497
Sx: 93
n: 55
C-Level: .99

The results include the following:

(463.52,530.48)

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 TEST, option ***T-Test***. Then choose *Stats*, and enter the following information:

μ0:514
$\bar{x}$: 490
Sx: 98
n: 56

For a left-tail test, choose the <μ0 option, then use the *Calculate* option. The results include the following:

t=-1.832648516
p=.0361350842

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