The T-Test and T-Interval Using the TI-89

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Textbook Correlation: Key Topic

- Statistical Inference: Hypothesis Test for Means (One sample T-Test)
- Statistical Inference: Confidence Interval for Means (T-Interval)
- Univariate Data: Measures of Center (Mean)

NCTM Principles and Standards:

- Process Standard
    - Representation
    - Connections
    - Problem Solving

Description

The purpose of this activity is to apply inferential statistics using a T-Test and a T-Interval to analyze a random sample and determine the validity of a report.

A bank branch manager needs to hire more tellers. The branch manager reports to the bank president that the average number of customers per day is 200. The bank president hires a statistician to determine the validity of the report. A random sample of the number of visitors on each of five days is as follows: 190, 155, 220, 195, and 175. Does this sample give the bank president enough evidence to doubt the branch manager's report?
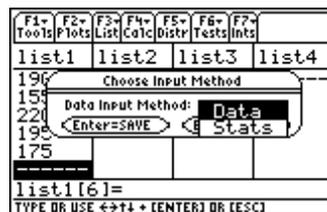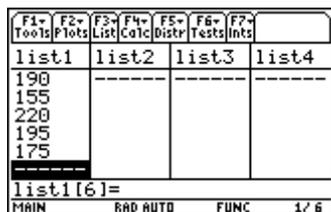
Solution:

First the statistician checks the one variable statistics information on the TI-89. Enter the data in the List Editor. Press **F4 Calc** and select **1: 1-Var Stats**. The sample mean, 187, is lower than the 200 reported by the branch manager.
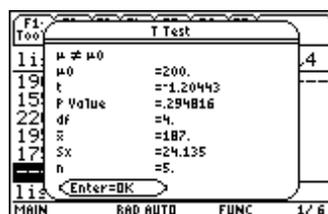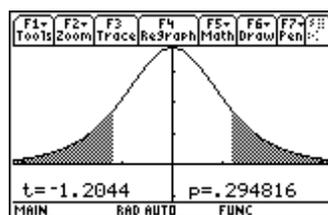
Before disagreeing with the branch manager, the statistician decides to apply inferential statistics by performing an hypothesis test.

The Null Hypothesis H$_o$ is $\mu = 200$. The Alternative Hypothesis H$_a$ is $\mu \neq 200$.

First enter the data in the List Editor. Select **T-Test** for Test and **Data** for Input Method.
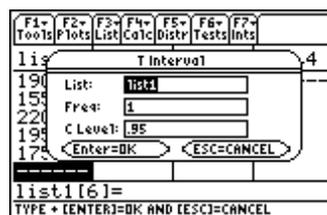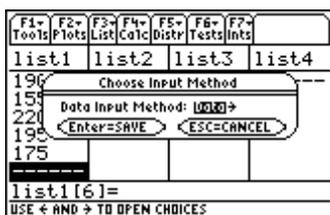
```
F1- F2- F3- F4- F5- F6- F7-          F1- F2- F3- F4- F5- F6 F7-         F1- F2- F3- F4- F5- F6- F7-
Tools Plots List Calc Distr Tests Ints  Tools Plots List Calc Distr Tests Ints  Tools Plots List Calc Distr Tests Ints
list1 list2 list3 list4              list1  li 1:Z-Test...              list1 list2 list3 list4
190   ----- ----- -----              190    -- 2:T-Test...             196   Choose Input Method
155                                  155       3:2-SampZTest...        155
220                                  220       4:2-SampTTest...        22  Data Input Method: Data
195                                  195       5:1-PropZTest...        196  Enter=SAVE    Stats
175                                  175       6:2-PropZTest...        175
-----                                -----     7:Chi2 GOF...           -----
list1[6]=                            list1[6]= 8↓Chi2 2-way...         list1[6]=
MAIN  RAD AUTO  FUNC   1/6           MAIN   RAD AUTO  FUNC  1/6        TYPE OR USE ←→↑↓ + [ENTER] OR [ESC]
```

Enter **200** for μ_0, list1 for List, $\mu \neq \mu_0$ for Alternate Hyp and either **Draw** or **Calculate** as illustrated below.

```
F1- F2- F3- F4- F5- F6- F7-          F1- F2- F3  F4  F5- F6- F7-
Too          T Test                  Tools Zoom Trace ReGraph Math Draw Pen
li  μ0:      200          4
19  List:    list1       --
15  Freq:    1
22                                            (normal curve with shaded tails)
19  Alternate Hyp: μ≠μ0→
17  Results:      Calculate
--  Enter=OK      Draw
list1[6]=                            t=-1.2044        p=.294816
MAIN   RAD AUTO  FUNC  1/6           MAIN   RAD AUTO  FUNC
```

```
F1- F2- F3- F4- F5- F6- F7-          F1-          T Test
Too          T Test                  Too   μ≠μ0
li  μ0:      200          4          li   μ0      =200.          4
19  List:    list1       --          19   t        =-1.20443    --
15  Freq:    1                       15   P Value  =.294816
22                                   22   df       =4.
19  Alternate Hyp: μ≠μ0→             19   x̄        =187.
17  Results:      Calculate          17   Sx       =24.135
--  Enter=OK      Draw               --   n         =5.
list1[6]=                            li  Enter=OK
TYPE OR USE ←→↑↓ + [ENTER] OR [ESC]  MAIN   RAD AUTO  FUNC  1/6
```

The statistician is convinced by the p value of .294816 that there is not enough evidence to doubt the branch manager's claim. To be certain, the statistician decides to check a 95% Confidence interval on the TI-89.

Select **TInterval** for Ints, **Data** for Input Method, **list1** for List, and **.95** for CLevel.

```
F1- F2- F3- F4- F5- F6 F7-           F1- F2- F3- F4- F5- F6- F7-         F1- F2- F3- F4- F5- F6- F7-
Tools Plots List Calc Distr Tests Ints  Tools Plots List Calc Distr Tests Ints  Tools Plots List Calc Distr Tests Ints
list1 list  1:ZInterval...           list1 list2 list3 list4             li          T Interval       4
190   ----  2:TInterval...           190   Choose Input Method           190  List:   list1
155         3:2-SampZInt...          155                                 155  Freq:   1               --
220         4:2-SampTInt...          220  Data Input Method: Data→       22
195         5:1-PropZInt...          195  Enter=SAVE   ESC=CANCEL        195  C Level: .95
175         6:2-PropZInt...          175                                 175  Enter=OK    ESC=CANCEL
-----       7:LinRegTInt...          -----                               -----
            8:MultRegInt...
list1[6]=                            list1[6]=                           list1[6]=
MAIN   RAD AUTO  FUNC  1/6           USE ← AND → TO OPEN CHOICES         TYPE + [ENTER]=OK AND [ESC]=CANCEL
```

```
┌F1┬┐┌F2┬┐┌F3┬┐┌F4┬┐┌F5┬┐┌F6┬┐┌F7┬┐
│Too│          T Interval
│li┌─────────────────────────┐ 4
│19│ C Int     =(157.,217.)   │───
│15│ x̄         =187.          │
│22│ ME        =29.9676       │
│19│ df        =4.            │
│17│ Sx        =24.135        │
│  │ n         =5.            │
│──└──── Enter=OK ──────────┘
│list1[6]=
│MAIN        RAD AUTO    FUNC    1/6
```

The statistician is assured that it is reasonable to accept the branch manager's claim that he aveages 200 customers per day since 200 is included in the 95% Confidence Interval (157, 217.3). He presents the statisical analysis to the bank president.

References

Connors, M.A. and Connors, E.A. (in press). "Statistics With The TI-89 Statistics Flash Application And List Editor," *Proceedings of the Fourteenth International Conference on Technology in Collegiate Mathematics, Baltimore, MD*, November 1-4, 2001. Reading, MA: Addison Wesley.