

TI-83/84 Plus

Statistics Tutorial

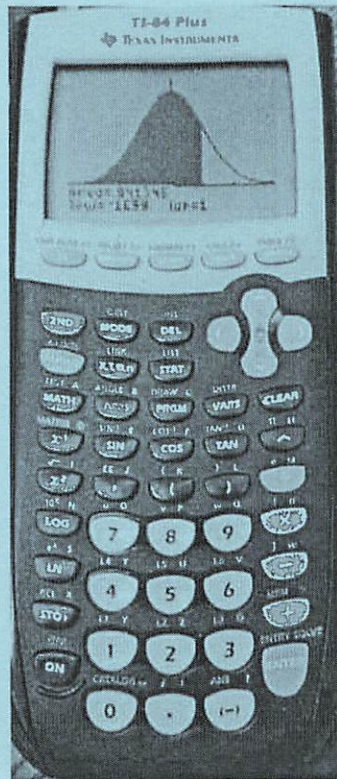


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TI-83/84 Plus Statistics Tutorial

Finding One Variable Statistics for a list of data

First enter the data in list L1 by pressing **STAT**, then selecting **EDIT** and pressing the **ENTER** key. After the data values have been entered, press **STAT** and select **CALC**, then select **1-Var Stats** and press the **ENTER** key *twice*. The display will include the mean \bar{x} , the median, the minimum value, and the maximum value. Use the down-arrow key to see the results that don't fit on the initial display.

```

2nd 0= CALC TESTS
1:Edit...
2:SortA(
3:SortD(
4:ClrList
5:SetUpEditor
    
```

```

L1 | L2 | L3 | 1
---|---|---|---
21 |    |    |
23 |    |    |
16 |    |    |
20 |    |    |
26 |    |    |
20 |    |    |
25 |    |    |
L1(1)=21
    
```

```

EDIT 2nd 0= TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7:QuartReg
    
```

```

1-Var Stats
x=22.75
Σx=273
Σx²=6429
Sx=4.454313538
σx=4.264680527
↓n=12
    
```

Summary Statistics

\bar{x}	the mean or average	
$\sum x$	the sum of all the data	
$\sum x^2$	the sum of the squares	
Sx	the sample standard deviation	
σx	the population standard deviation	
n	the number of elements	
$minX$	the minimum element	} 5-Number Summary
Q_1	the first quartile	
Med	the median of the data	
Q_3	the third quartile	
$maxX$	the maximum element	

Calculating Permutations, Combinations, and Factorials

To calculate a permutation, first enter the value for n , then press **MATH**, select **PRB** and **nPr**, then enter the value for r , and press the **ENTER** key.

To calculate a combination, enter the value for n , then press **MATH**, select **PRB** and **nCr**, then enter the value for r , and press the **ENTER** key.

To calculate a factorial, first enter the number, then press **MATH** and select **PRB** and menu item 4.

```

MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
    
```

```

9 nCr 3      84
10 nPr 5     30240
5!           120
    
```

Clearing Lists

To clear a list from the data editor, move the cursor up to highlight the list name as shown below. Now, press **CLEAR** and then **ENTER**.

L1	L2	L3	1
110	-----	-----	
90			
110			
120			
95			
110			
165			

L1 = {110, 90, 110, ...}

L1	L2	L3	1
-----	-----	-----	

L1() =

To clear multiple lists, select **STAT**, then select **Edit** and choose option **4:ClrList** and enter the lists separated by commas as shown below.

L1	L2	L3	1
5	-----	-----	
-----	-----	-----	
-----	-----	-----	
-----	-----	-----	
-----	-----	-----	

L1() = 5

```

2nd STAT  CALC TESTS  ClrList L1,L2,L3
1: Edit...
2: SortA(
3: SortD(
4: ClrList
5: SetUpEditor
Done
    
```

To clear *all* lists go to **MEM** and select **4:ClrAllLists**, then press **ENTER**.

```

MEM  ClrAllLists  Done
1: About
2: Mem Mgmt/Del...
3: Clear Entries
4: ClrAllLists
5: Archive
6: UnArchive
7: Reset...
    
```

Histograms

First enter the data in list L1. Then press **2nd** and **Y=** (to get **STAT PLOT**). Press **ENTER** to select the first plot and then turn the plot on. Now select the graph type that resembles a histogram and set X-list to L1. If you want to let the calculator determine the class width and starting point, press the **ZOOM** button and arrow down to **ZoomStat** to get a histogram with default settings. To enter your own class width and class boundaries, press the **WINDOW** button and enter the maximum and minimum values. The Xscl value will be the class width. Then press **GRAPH** to obtain the graph.

L1	L2	L3	1
60	-----	-----	
60			
64			
64			
64			
64			

L1() = 60

```

2nd STAT PLOTS
1: Plot1...On
   L1 1
2: Plot2...Off
   L1 L2
3: Plot3...Off
   L1 L2
4: PlotsOff

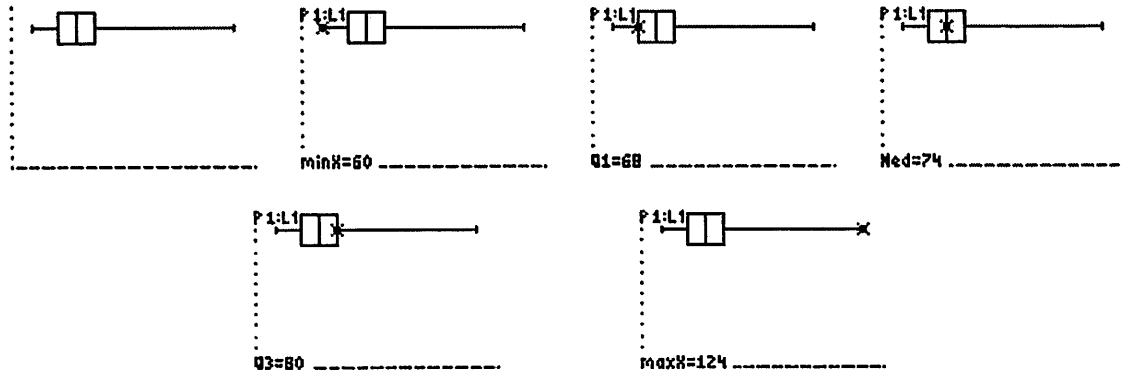
2nd P1ot2 P1ot3
On Off
Type: L1 L2 L3
Xlist: L1
Freq: 1
    
```

```

2nd MEMORY
4: ZDecimal
5: ZSquare
6: ZStandard
7: ZTrig
8: ZInteger
9: ZoomStat
0: ZoomFit
    
```

Box-and-Whisker Plot

To obtain a box-and-whisker plot, simply select the graph type that is positioned in the middle of the second row and follow the same steps as before for the histogram. Press the **TRACE** button and use the arrow keys to view the minimum value, first quartile, median, third quartile, or maximum value. Each screen shot below shows the trace cursor in a different location along with the value of $minX$, Q_1 , Med , Q_3 , and $maxX$ at the bottom left corner.



Calculating a Binomial Probability

To get to the binomial probability commands, press **2nd VARS** (to get **DISTR**, which denotes “distributions”), then select the option identified as **binompdf**(. or **binomcdf**(, depending on the probability we are trying to find. The variable n represents the fixed number of trials, p is the probability of success, and x is the number of successes. See the table below to determine which command to use and how to input the values. **The displays for the TI-83 and TI-84 calculators may be different when inputting the values of n , p , and x .**

Verbal Phrase	Symbol	Command
Probability of exactly x successes	$P(X = x)$	<code>binompdf(n, p, x)</code>
Probability of getting x successes		
Probability of at most x successes	$P(X \leq x)$	<code>binomcdf(n, p, x)</code>
Probability of less than or equal to x successes		
Probability of fewer than x successes	$P(X < x)$	<code>binomcdf($n, p, x - 1$)</code>
Probability of less than x successes		
Probability of at least x successes	$P(X \geq x)$	<code>1 - binomcdf($n, p, x - 1$)</code>
Probability of greater or equal to x successes		
Probability of more than x successes	$P(X > x)$	<code>1 - binomcdf(n, p, x)</code>
Probability of greater than x successes		
Probability of exceeding x successes		

Note that you only use the **binompdf** command when finding probabilities of the form $P(X = x)$.

Calculating a Normal Probability

1. Find probabilities of the form $P(x_1 < X < x_2)$

Press **2nd VARS**, then use the down arrow key to select **2:normalcdf** (normal cumulative density function), press the **ENTER** key, then enter the lower value x_1 , upper value x_2 , mean μ , and standard deviation σ , i.e., **normalcdf**(x_1, x_2, μ, σ). For example, the probability $P(45 < X < 60)$ would be entered as follows in the calculator (with $\mu = 40$ and $\sigma = 9$):

```

2ND 2 VARS DRAW      normalcdf(45,60,
1:normalpdf(          40,9)
2normalcdf(          .2761232249
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7↓X²pdf(

```

2. Finding probabilities of the form $P(X > x)$

Suppose we are asked to find $P(X > 60)$ when $\mu = 40$ and $\sigma = 9$. In this example, there is no specific upper value, so we use this trick: for the upper limit, enter a value that is excessively large to represent infinity, such as 999999 (or E99).

```

2ND 2 VARS DRAW      normalcdf(60,999
1:normalpdf(          999,40,9)
2normalcdf(          .0131341011
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7↓X²pdf(

```

3. Finding probabilities of the form $P(X < x)$

Suppose now that we want to find $P(X < 70)$ when $\mu = 40$ and $\sigma = 9$. There is no specific lower value, so we enter an excessively large negative value to represent negative infinity, such as -999999 (or -E99).

```

2ND 2 VARS DRAW      normalcdf(-99999
1:normalpdf(          9,70,40,9)
2normalcdf(          .9995708835
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7↓X²pdf(

```

Calculating a *Standard* Normal Probability

We can calculate a standard normal probability using the same procedures as above, except it's not necessary to enter values for μ and σ since the calculator uses $\mu = 0$ and $\sigma = 1$ by default (Recall that a standard normal distribution has mean $\mu = 0$ and standard deviation $\sigma = 1$). For example, to calculate the probability $P(-1 < z < 1)$, we enter it in the following manner: **normalcdf**(-1, 1).

Finding an x-value given a Normal Probability

To find values given a probability (or percentage), press **2nd**, **VARS**, **3** (for **invNorm**) and proceed to enter the following values, including the commas:

(total area to the *left*, μ , σ)

For example, assume that women's heights are normally distributed with a mean of 63.6 in. and a standard deviation of 2.5 in., and suppose we want to find the minimum height of the tallest 5% of women. The minimum height separates the bottom 95% from the top 5%; thus, the total area to the *left* is 0.95. The minimum height (67.7 in) is calculated as follows:

```
DISTR DRAW      invNorm(.95,63.6
1:normalpdf(    ,2.5)
2:normalcdf(    67.71213406
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
```

Note: Remember to use the area to the *left* of the desired value. In the above example, the area to the left of the minimum height of the tallest 5% of women is 0.95 and the area to the right of it is 0.05.

Finding a z-score given a Standard Normal Probability

We can find a z-score by using the command **invNorm(p)**, where p is the standard normal probability. In other words, $p = P(z < z_1)$, which is the area under the standard normal curve to the left of some unknown z-score z_1 .

For example, to calculate z_1 given a standard normal probability of $p = 0.85$, which is the area under the standard normal curve to the left of the unknown z-score z_1 , we enter it as follows:

```
DISTR DRAW      invNorm(0.85)
1:normalpdf(    1.03643338
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
```

Calculating a Poisson Probability

Press **2nd** **VARS** (to get **DISTR**), then select **poissonpdf**(. Now press **ENTER**, then proceed to enter μ , x (including the comma). For μ , enter the value of the mean; for x , enter the desired number of occurrences.

Finding a Confidence Interval for the Mean (σ Known)

We can generate confidence intervals for original sample values stored in a list, or you can use the summary statistics n , \bar{x} , and σ (highlight **Stats**, then press **ENTER**). Either enter the data in list L1 or have the summary statistics available, then press the **STAT** key. Now select **TESTS** and choose **ZInterval** if σ is known.

1. Finding a confidence interval *given a list of data*

<table border="1" style="border-collapse: collapse; width: 100px; text-align: center;"> <tr><td>L1</td><td>L2</td><td>L3</td><td>1</td></tr> <tr><td>98.6</td><td>---</td><td>---</td><td></td></tr> <tr><td>98</td><td></td><td></td><td></td></tr> <tr><td>97.3</td><td></td><td></td><td></td></tr> <tr><td>97.2</td><td></td><td></td><td></td></tr> <tr><td>97.8</td><td></td><td></td><td></td></tr> <tr><td>97.3</td><td></td><td></td><td></td></tr> </table>	L1	L2	L3	1	98.6	---	---		98				97.3				97.2				97.8				97.3				<pre> EDIT CALC TESTS 1:Z-Test... 2:T-Test... 3:2-SampZTest... 4:2-SampTTest... 5:1-PropZTest... 6:2-PropZTest... ZInterval... </pre>	<pre> ZInterval Inpt:DATA Stats σ: .62 List:L1 Freq:1 C-Level: .95 Calculate </pre>	<pre> ZInterval (98.082,98.318) x̄=98.2 Sx=.6228964601 n=106 </pre>
L1	L2	L3	1																												
98.6	---	---																													
98																															
97.3																															
97.2																															
97.8																															
97.3																															

2. Finding a confidence interval *given statistics*

<pre> EDIT CALC TESTS 1:Z-Test... 2:T-Test... 3:2-SampZTest... 4:2-SampTTest... 5:1-PropZTest... 6:2-PropZTest... ZInterval... </pre>	<pre> ZInterval Inpt:Data STATS σ: .62 x̄:98.2 n:106 C-Level: .95 Calculate </pre>	<pre> ZInterval (98.082,98.318) x̄=98.2 n=106 </pre>
---	---	--

Finding a Confidence Interval for the Mean (σ Unknown)

Follow the same procedure as above, except use **TInterval** (option 8) instead of **ZInterval**. Since σ is unknown, we will use s as an approximation to σ .

<pre> TInterval Inpt:DATA Stats List:L1 Freq:1 C-Level: .95 Calculate </pre>	<pre> TInterval Inpt:Data STATS x̄:98.2 Sx:.6228964600... n:106 C-Level: .95 Calculate </pre>
--	--

Finding a Confidence Interval for a Proportion

Press **STAT**, select **TESTS**, then select **1-PropZInt** and proceed to enter the required items.

<pre> EDIT CALC TESTS 6:2-PropZTest... 7:ZInterval... 8:TInterval... 9:2-SampZInt... 0:2-SampTInt... 1:1-PropZInt... B:2-PropZInt... </pre>	<pre> 1-PropZInt x:585 n:1500 C-Level: .95 Calculate </pre>	<pre> 1-PropZInt (.36532,.41468) p̂=.39 n=1500 </pre>
---	---	---

Finding a Confidence Interval for a Population Standard Deviation or Variance

You can use the **S2INT** to find confidence intervals for a population standard deviation or variance. You can access the program by going to **PRGM**, then arrow down until you find **S2INT**. If your calculator does not have **S2INT**, go up to the **TMARC** counter and we will transfer the programs to your calculator. If your calculator does have **S2INT**, select it and press **ENTER** and press **ENTER** again to run the program. Then enter the sample variance s^2 , the sample size n , and the confidence level (such as 0.95). Press the **ENTER** key, and wait a while for the display of the confidence interval limits for σ^2 . Press **ENTER** again to display the confidence interval limits for σ . To exit the program, press **ENTER** one more time.

```

EXEC EDIT NEW          EXEC EDIT NEW          prgmS2INT
1:CHI2DIST             ↑PROCTINT
2:CHISQR               :PROCTVAL
3:FVAL                 :PSZ
4:GOF                   :RVAL
5:GSPRL                ■S2INT
6:HISTPRB              :S2TEST
7↓INVCHI2              ↓SAMPLSIZ
    
```

```

prgmS2INT
INPUT: STATS
Sx²=.15²
n=10
C-LEVEL=.95■

Sx²=.15²
n=10
C-LEVEL=.95
σ² INTERVAL:
C.0106451386 .0...
σx INTERVAL:
C.1031752811 .2...
    
```

Finding a Confidence Interval for Two Population Proportions

Press **STAT**, then select **TESTS** and arrow down to find **2-PropZInt** and proceed to enter the required items. You will also be asked to enter the confidence level (such as 0.95). Arrow down to highlight **Calculate** and then press the **ENTER** key. The confidence interval will be displayed along with the sample proportions \hat{p}_1 and \hat{p}_2 and the sample sizes n_1 and n_2 .

```

2ND) CALC TESTS      EDIT CALC TESTS      2-PropZInt      2-PropZInt
1:Edit...             7↑ZInterval...      x1:41            (-.0035,7.1E-5)
2:SortA(              8:TInterval...      n1:11541         p1=.0035525518
3:SortD(              9:2-SampZInt...     x2:52            p2=.0052775804
4:ClrList             0:2-SampTInt...     n2:9853          n1=11541
5:SetUpEditor         A:1-PropZInt...     C-Level:.95      n2=9853
                     B:2-PropZInt...     Calculate
                     C↓x²-Test...
    
```

Finding a Confidence Interval for Two Means: Independent Samples

First enter the data in list L1 and L2 if you are given data. Then press **STAT**, select **TESTS**, and then choose **2-SampTInt**. Highlight **Data**, press **ENTER**, and make sure you are working with lists L1 and L2. Input the confidence level, highlight **No** for Pooled, highlight **Calculate** and press **ENTER**.

<pre> 2nd) CALC TESTS 1) Edit... 2) SortA(3) SortD(4) ClrList 5) SetUpEditor </pre>	<table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>L1</th> <th>L2</th> <th>L3</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>19.5</td> <td>20.4</td> <td>-----</td> <td></td> </tr> <tr> <td>20.5</td> <td>21.5</td> <td></td> <td></td> </tr> <tr> <td>19.6</td> <td>22.3</td> <td></td> <td></td> </tr> <tr> <td>20.2</td> <td>22.3</td> <td></td> <td></td> </tr> <tr> <td>17.8</td> <td>20.3</td> <td></td> <td></td> </tr> <tr> <td>17.8</td> <td>18.8</td> <td></td> <td></td> </tr> <tr> <td>19.1</td> <td>18.9</td> <td></td> <td></td> </tr> </tbody> </table> <p>L2(1)=20.4</p>	L1	L2	L3	2	19.5	20.4	-----		20.5	21.5			19.6	22.3			20.2	22.3			17.8	20.3			17.8	18.8			19.1	18.9			<pre> EDIT CALC TESTS 6) 2-PropZTest... 7) ZInterval... 8) TInterval... 9) 2-SampZInt... 0) 2-SampTInt... A) 1-PropZInt... B) 2-PropZInt... </pre>
L1	L2	L3	2																															
19.5	20.4	-----																																
20.5	21.5																																	
19.6	22.3																																	
20.2	22.3																																	
17.8	20.3																																	
17.8	18.8																																	
19.1	18.9																																	

<pre> 2-SampTInt Inpt: Data Stats List1: L1 List2: L2 Freq1: 1 Freq2: 1 C-Level: .9 ↓Pooled: No Yes </pre>	<pre> 2-SampTInt (-2.442, -.3577) df=17.19040919 x1=18.76 x2=20.16 Sx1=1.18621714 Sx2=1.47888847 </pre>
--	---

If you are given summary statistics, follow the same steps as above except highlight **Stats** instead of **Data**. Then proceed to enter the required items.

Finding a Confidence Interval for Two Means: Dependent Samples (Matched Pairs)

First enter the data in list L1 and L2. Then highlight L3 as shown in the third screen shot below, input L1-L2, and then press the **ENTER** key. List L3 will now contain the individual differences d . Now press **STAT**, then select **TESTS**, and choose the option **TInterval**. Use the input option of **Data**. For the list, enter L3. Also enter the confidence level (such as 0.95). Press **ENTER** when done.

<pre> 2nd) CALC TESTS 1) Edit... 2) SortA(3) SortD(4) ClrList 5) SetUpEditor </pre>	<table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>L1</th> <th>L2</th> <th>L3</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>20.15</td> <td>20.68</td> <td>-----</td> <td></td> </tr> <tr> <td>19.24</td> <td>19.48</td> <td></td> <td></td> </tr> <tr> <td>20.77</td> <td>19.59</td> <td></td> <td></td> </tr> <tr> <td>23.85</td> <td>24.57</td> <td></td> <td></td> </tr> <tr> <td>21.32</td> <td>20.96</td> <td></td> <td></td> </tr> <tr> <td>-----</td> <td>-----</td> <td></td> <td></td> </tr> </tbody> </table> <p>L2(6) =</p>	L1	L2	L3	2	20.15	20.68	-----		19.24	19.48			20.77	19.59			23.85	24.57			21.32	20.96			-----	-----			<table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>L1</th> <th>L2</th> <th>L3</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>20.15</td> <td>20.68</td> <td>-----</td> <td></td> </tr> <tr> <td>19.24</td> <td>19.48</td> <td></td> <td></td> </tr> <tr> <td>20.77</td> <td>19.59</td> <td></td> <td></td> </tr> <tr> <td>23.85</td> <td>24.57</td> <td></td> <td></td> </tr> <tr> <td>21.32</td> <td>20.96</td> <td></td> <td></td> </tr> <tr> <td>-----</td> <td>-----</td> <td></td> <td></td> </tr> </tbody> </table> <p>L3 = L1 - L2</p>	L1	L2	L3	3	20.15	20.68	-----		19.24	19.48			20.77	19.59			23.85	24.57			21.32	20.96			-----	-----			<table border="1" style="border-collapse: collapse; text-align: center;"> <thead> <tr> <th>L1</th> <th>L2</th> <th>L3</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>20.15</td> <td>20.68</td> <td>-.53</td> <td></td> </tr> <tr> <td>19.24</td> <td>19.48</td> <td>-.24</td> <td></td> </tr> <tr> <td>20.77</td> <td>19.59</td> <td>1.18</td> <td></td> </tr> <tr> <td>23.85</td> <td>24.57</td> <td>-.72</td> <td></td> </tr> <tr> <td>21.32</td> <td>20.96</td> <td>.36</td> <td></td> </tr> <tr> <td>-----</td> <td>-----</td> <td>-----</td> <td></td> </tr> </tbody> </table> <p>L3(1) = -.53</p>	L1	L2	L3	3	20.15	20.68	-.53		19.24	19.48	-.24		20.77	19.59	1.18		23.85	24.57	-.72		21.32	20.96	.36		-----	-----	-----	
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20.77	19.59	1.18																																																																																					
23.85	24.57	-.72																																																																																					
21.32	20.96	.36																																																																																					
-----	-----	-----																																																																																					

<pre> EDIT CALC TESTS 2) T-Test... 3) 2-SampZTest... 4) 2-SampTTest... 5) 1-PropZTest... 6) 2-PropZTest... 7) ZInterval... 0) TInterval... </pre>	<pre> TInterval Inpt: Data Stats List: L3 Freq: 1 C-Level: .9 Calculate </pre>	<pre> TInterval (-.7252, .74516) x=.01 Sx=.7711031059 n=5 </pre>
---	--	--

Hypothesis Test for the Mean (σ is known)

Press **STAT**, then select **TESTS** and choose the first option, **Z-Test**. You can use the original data or the summary statistics (**Stats**) by providing the entries indicated in the window display. You will also be asked to select the alternative hypothesis, which will be one of the following: $\mu \neq \mu_0$, $\mu < \mu_0$, or $\mu > \mu_0$. The first three items of the results will include the alternative hypothesis, the test statistics, and the P-value.

1. Given a list of data

L1	L2	L3	1
98.6			
98			
97.3			
97.2			
97.8			
97.3			

L1()=98.6

```

EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:ZInterval...
    
```

```

Z-Test
Inpt:Data Stats
μ₀:98.6
σ: .62
List:L1
Freq:1
μ: [ ] <μ₀ >μ₀
Calculate Draw
    
```

```

Z-Test
μ≠98.6
z=-6.642342026
P=3.1039E-11
x̄=98.2
Sx=.6228964601
n=106
    
```

2. Given statistics

L1	L2	L3	1
98.6			
98			
97.3			
97.2			
97.8			
97.3			

L1()=98.6

```

Z-Test
Inpt:Data Stats
μ₀:98.6
σ: .62
x̄:98.2
n:106
μ: [ ] <μ₀ >μ₀
Calculate Draw
    
```

```

Z-Test
μ≠98.6
z=-6.642342026
P=3.1039E-11
x̄=98.2
n=106
    
```

Hypothesis Test for the Mean (σ Unknown)

Follow the same procedure as above, except use **T-Test** instead of **Z-Test**. Since σ is unknown, we will use s as an approximation to σ .

Hypothesis Test for a Proportion

Press **STAT**, select **TESTS**, and then select **1-PropZTest**. Enter the claimed value of the population proportion for p_0 , then enter the values for x and n , and then select the alternative hypothesis. Highlight **Calculate**, then press the **ENTER** key.

```

EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:ZInterval...
    
```

```

1-PropZTest
P₀: .75
x:585
n:1500
P: [ ] <P₀ >P₀
Calculate Draw
    
```

```

1-PropZTest
PROP≠.75
z=-32.19937888
P=0
p̂=.39
n=1500
    
```

Hypothesis Test for Standard Deviation or Variance

You can use **S2TEST** for a hypothesis test for the standard deviation or variance. You can access the program by going to **PRGM**, then arrow down until you find **S2TEST**. If your calculator does not have **S2TEST**, go up to the TMARC counter and we'll transfer the programs to your calculator. If your calculator does have **S2TEST**, select it and press **ENTER** and press **ENTER** again to run the program. You will be asked to input the *population* variance σ^2 , the sample variance s^2 , and the sample size n . Then select the format used for the alternative hypothesis and press the **ENTER** key. The test statistic and P -value will be displayed.

```

PRGM EDIT NEW      PRGM EDIT NEW      PRGM S2TEST
1: CH12DIST        1: PROCTVAL
2: CHISQR          2: PSZ
3: FVAL           3: RVAL
4: GOF            4: S2INT
5: GSPRL         5: S2TEST
6: HISTPRB       6: SAMPLSIZ
7: INVCHI2       7: SOLVGRAF

PRGM S2TEST
INPUT: STATS
σx²=.0230²
Sx²=.01648²
n=37

SIGMA²
1: ≠SIGMA0²
2: <SIGMA0²
3: >SIGMA0²
4: QUIT

S² TEST
SIGMA²<2.715904e
X²=18.4825225
P=.0068732909
Done
    
```

Hypothesis Test for Two Proportions

Press **STAT**, select **TESTS**, and then select **2-PropZTest** and proceed to enter the required items. Then select the format used for the alternative hypothesis and press the **ENTER** key. The calculator will then output the test statistic, the P -value, the sample proportions \hat{p}_1 and \hat{p}_2 , the pooled sample proportion \bar{p} , and the sample sizes n_1 and n_2 .

```

CALC TESTS      EDIT CALC TESTS      2-PropZTest      2-PropZTest
1: Edit...      1: Z-Test...      x1:41            P1<P2
2: SortA(      2: T-Test...      n1:11541        Z=-1.91164305
3: SortD(      3: 2-SampZTest... x2:52           P=.0279609289
4: ClrList     4: 2-SampTTest... n2:9853        p1=.0035525518
5: SetUpEditor 5: 1-PropZTest... p1:≠p2 <=> >p2 p2=.0052775804
                6: 2-PropZTest... Calculate Draw  ↓p̄=.0043470132
                7: Interval...
    
```

Hypothesis Test for Two Means: Independent Samples

First enter the data in list L1 and L2 if you are given data. Then press **STAT**, select **TESTS**, and then choose **2-SampTTest**. Highlight **Data**, press **ENTER**, and make sure you are working with lists L1 and L2. Then select the format for the alternative hypothesis, highlight **No** for Pooled, highlight **Calculate** and press **ENTER**.

```

2nd [F2] CALC TESTS
1:Edit...
2:SortA(
3:SortD(
4:ClrList
5:SetUPEditor
    
```

L1	L2	L3	2
19.5	20.4		
20.3	21.9		
19.6	22.1		
20.2	20.3		
17.8	18.8		
19.1	18.9		

L2(1)=20.4

```

EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:Interval...
    
```

```

2-SampTTest
Inpt: Data Stats
List1:L1
List2:L2
Freq1:1
Freq2:1
μ1:≠μ2 <μ1 >μ2
Pooled: No Yes
    
```

```

2-SampTTest
μ1<μ2
t=-2.335208018
p=.0159501002
df=17.19040919
x1=18.76
x2=20.16
    
```

If you are given summary statistics, follow the same steps as above except highlight **Stats** instead of **Data**. Then proceed to enter the required items.

Hypothesis Test for Two Means: Dependent Samples (Matched Pairs)

First enter the data in list L1 and L2. Then highlight L3 as shown in the third screen shot below, input L1-L2, and then press the **ENTER** key. List L3 will now contain the individual differences d . Now press **STAT**, then select **TESTS**, and choose the option **T-Test**. Use the input option of **Data**. For the list, enter L3. Also enter the assumed value of the population mean difference (typically 0) for μ_0 and select the format for the alternative hypothesis. Press **ENTER** when done.

```

2nd [F2] CALC TESTS
1:Edit...
2:SortA(
3:SortD(
4:ClrList
5:SetUPEditor
    
```

L1	L2	L3	2
20.15	20.68		
19.24	19.48		
20.77	19.59		
23.85	24.57		
21.32	20.96		

L2(6) =

L1	L2	L3	3
20.15	20.68		
19.24	19.48		
20.77	19.59		
23.85	24.57		
21.32	20.96		

L3=L1-L2

L1	L2	L3	3
20.15	20.68		
19.24	19.48		
20.77	19.59		
23.85	24.57		
21.32	20.96		

L3(1)=-.53

```

EDIT CALC TESTS
1:Z-Test...
2:T-Test...
3:2-SampZTest...
4:2-SampTTest...
5:1-PropZTest...
6:2-PropZTest...
7:Interval...
    
```

```

T-Test
Inpt: Data Stats
μ0:0
List:L3
Freq:1
μ:≠μ0 <μ0 >μ0
Calculate Draw
    
```

```

T-Test
μ≠0
t=.0289983007
p=.9782550837
x=.01
Sx=.7711031059
n=5
    
```

Goodness-of-Fit

First enter the data in list L1 and L2. The observed frequencies go in list L1 and the expected frequencies go in list L2. Then press **PRGM** and select **GOF** (or **X2GOF**). Press **ENTER** to execute the program. Input the degrees of freedom and press **ENTER**. The final display will show the test statistic χ^2 and the *P*-value.

```

L1 | L2 | L3 | 1
---|---|---|---
7 | 8 |   | ---
14 | 8 |   | ---
10 | 8 |   | ---
10 | 8 |   | ---
5 | 8 |   | ---
L1(1)=7

```

```

PRGM EDIT NEW      PrgmGOF
1:CHI2DIST
2:CHISQR
3:FVAL
4:GOF
5:GSPRL
6:HISTPRB
7↓INVCHI2

```

```

X2GOF-TEST
HAVE YOU ENTERED
DATA INTO
L1 AND L2?
DF (INTEGER ≥ 1)
?

```

```

OBSERVED L1
EXPECTED L2
X²= 11.25
P= .2589612558
CNTRB=
(.125 4.5 .5 .5)

```

Contingency Tables

First enter the contingency table as a matrix. Press **2nd** followed by the χ^{-1} key (to get **MATRIX**). Arrow to the right to highlight **EDIT**, then press **ENTER** to edit matrix [A]. Now enter the dimensions of the matrix (rows by columns) and proceed to enter the individual frequencies. When you're done entering the contingency table, press **STAT**, highlight **TESTS**, and select χ^2 -Test. Set **Observed** to matrix [A] and **Expected** to matrix [B] and then highlight **Calculate** and press **ENTER**. The final display will show the test statistic, the *P*-value, and the degrees of freedom. The expected frequencies are stored in matrix [B].

```

NAMES MATH EDIT      NAMES MATH EDIT
1:[A]
2:[B]
3:[C]
4:[D]
5:[E]
6:[F]
7↓[G]

```

```

MATRIX[A] 2 × 3
[ 0  0  0 ]
[ 0  0  0 ]
1, 1=0

```

```

MATRIX[A] 2 × 3
[ 88  48  42 ]
[ 15  4  10 ]
2, 3=10

```

```

EDIT CALC TESTS
9↑2-SampZInt...
0:2-SampZInt...
A:1-PropZInt...
B:2-PropZInt...
X²-Test...
D:X2GOF-Test...
E↓2-SampFTest...

```

```

Observed: [A]
Expected: [B]
Calculate Draw

```

```

X²=2.925496946
P=.231598856
df=2

```

```

MATRIX[B] 2 × 3
[ 88.57  44.715  44.715 ]
[ 14.43  7.285  10.285 ]
2, 3=7.285024154...

```

One-Way ANOVA

First enter the data in lists L1, L2, L3, ... then press **STAT**, select **TESTS**, and choose the option **ANOVA**. We will then enter the lists L1, L2, L3, ... separated with commas. Then press **ENTER**.

L1	L2	L3	3
38	47	37	
43	42	33	
42	37	38	
45	43	45	
44	44	43	
50	34	42	

L3(11) =			

```

EDIT CALC TESTS
B:2-PropZInt...
C:X2-Test...
D:X2GOF-Test...
E:2-SampFTest...
F:LinRegTTest...
G:LinRegInt...
H:ANOVA<

```

```

ANOVA(L1,L2,L3)

```

```

One-Way ANOVA
F=4.094413408
p=.0279863448
Factor
df=2
SS=162.866667
MS=81.4333333

```

Correlation and Regression

Enter the paired data in lists L1 and L2, then press **STAT** and select **TESTS**. Using the option of **LinRegTTest** will result in several displayed values, including the value of the linear correlation coefficient r . Set the X -list to L1 and the Y -list to L2. Choose $\neq 0$ for the alternative hypothesis, highlight **Calculate** and then press the **ENTER** key. Use the up and down arrow key to display other values.

```

EDIT CALC TESTS
1:Edit...
2:SortA<
3:SortD<
4:ClrList
5:SetUPEditor

```

L1	L2	L3	2
14	8.1		
6	6.13		
4	3.1		
12	9.13		
7	7.26		
5	4.74		

L2(12) =			

```

EDIT CALC TESTS
B:2-PropZInt...
C:X2-Test...
D:X2GOF-Test...
E:2-SampFTest...
F:LinRegTTest...
G:LinRegInt...
H:ANOVA<

```

```

LinRegTTest
Xlist:L1
Ylist:L2
Freq:1
B & P:  $\neq$  <0 >0
RegEQ:
Calculate

```

```

LinRegTTest
y=a+bx
B $\neq$ 0 and P $\neq$ 0
r=.0021788162
df=9
a=3.000909091
b=.5

```

The regression line has the format $y = a + bx$, where $a = 3.000909091$ and $b = .5$ in the example above (see the last screen shot above). In other words, the regression line for the example above is $y = 3.000909091 + .5x$.

To obtain a scatterplot, press **2nd**, then **Y=** (for STAT PLOT). Select the first option and press **ENTER**. Press enter again to turn Plot 1 on, then select the first graph type, which resembles a scatterplot. Set the X -list to L1 and the Y -list to L2. Now press the **ZOOM** key and select **ZoomStat**. It will now display a scatterplot as shown below.

```

STAT PLOTS
1:Plot1...On
  L1 L2
2:Plot2...Off
  L1 L2
3:Plot3...Off
  L1 L2
4:PlotsOff

```

```

P1On P1On P1On
On Off
Type: SCAT
Xlist:L1
Ylist:L2
Mark: .

```

```

MEMORY
4:ZDecimal
5:ZSquare
6:ZStandard
7:ZTrig
8:ZInteger
9:ZoomStat
0:ZoomFit

```


If you would also like to display the regression line along with the scatterplot, press the **Y=** button and enter the regression line for **Y1=** by going to **VARS**, then select **Statistics**, highlight **EQ**, and choose option **1:RegEQ**. Then press the **GRAPH** button. It will now display the scatterplot along with the regression line as shown in the last screen shot below.

