

Statistics and Distributions on the TI-83/84

The TI-83/84 family of graphing calculators comes equipped with many statistics functions, from simple computations to complex tests. We will discuss in this handout several distributions commonly used in statistics courses. The steps below are nearly identical across all TI-83's and TI-84's with two exceptions. First, this handout focuses on the TI-83 Plus and higher. If you are using the original TI-83 (without "Plus" in the title) then the keyboard layout is slightly different; you may need to modify the directions on this handout accordingly. Second, the latest update to the TI-84 (currently version 2.55MP) introduced a Statistics Wizard, which greatly simplified the usage of many statistics functions. To find out if your TI-84 has the latest update, press $\boxed{2\text{nd}} \rightarrow \boxed{+}$ for "MEM" $\rightarrow \boxed{\text{ENTER}}$ for the "About" screen. The version number will be under "TI-84 Plus". Press $\boxed{2\text{nd}} \rightarrow \boxed{\text{MODE}}$ for "QUIT" to exit back to the Home screen.

Most of the directions on this handout present a side-by-side comparison between different versions of the TI-83/84 graphing calculator family. Simply follow the screenshots that match your device. Also, the menus shown in the screenshots will differ slightly between the TI-83 and TI-84. For compatibility reasons, most of these screenshots were captured from the TI-83 Plus.

Entering and Editing Data in a List

ALL

We input or edit data in the calculator via the List Editor. Press $\boxed{\text{STAT}}$ to enter the Statistics menu, then press $\boxed{\text{ENTER}}$ for "Edit...".

```

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

We will be using two lists of values for this example and the next two. Enter into the first list (L_1) the values 16, 20, 17, 19, 22, 17, 17, 17, 10, and 18 by typing each number and then pressing $\boxed{\text{ENTER}}$. That is, 16 $\rightarrow \boxed{\text{ENTER}}$ \rightarrow 20 $\rightarrow \boxed{\text{ENTER}}$...

Press the $\boxed{\blacktriangleright}$ key to scroll over to the second list. As with L_1 , enter the values 45, 55, 70, 50, 47, 46, 50, 66, 26, and 60 into L_2 . You should now see the screen on the right. To exit the List Editor, press $\boxed{2\text{nd}} \rightarrow \boxed{\text{MODE}}$ for "QUIT".

L1	L2	L3	Σ
22	47		
17	46		
17	50		
17	66		
10	26		
18	60		

L2(1) =			

One-Variable Statistics

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>To compute the mean and standard deviation (and more) on L_1, press STAT → ▶ → ENTER for “1-Var Stats”.</p>	<pre>EDIT [DEL] TESTS 1:1-Var Stats 2:2-Var Stats 3:Med-Med 4:LinReg(ax+b) 5:QuadReg 6:CubicReg 7↓QuartReg</pre>	<pre>EDIT [DEL] TESTS 1:1-Var Stats 2:2-Var Stats 3:Med-Med 4:LinReg(ax+b) 5:QuadReg 6:CubicReg 7↓QuartReg</pre>
<p>Press 2nd → 1 to paste “L_1” onto the screen. For the 2.55MP version of the TI-84, make sure that the cursor is beside “List:” before pressing 2nd → 1, then scroll down to “Calculate”. Press ENTER.</p>	<pre>1-Var Stats L1</pre>	<pre>1-Var Stats List:L1 FreqList: Calculate</pre>
<p>Use the ▲ and ▼ arrow keys to scroll through all of the results.</p>	<pre>1-Var Stats x̄=17.3 Σx=173 Σx²=3081 Sx=3.128720008 σx=2.968164416 ↓n=10</pre>	<pre>1-Var Stats x̄=17.3 Σx=173 Σx²=3081 Sx=3.128720008 σx=2.968164416 ↓n=10</pre>

Two-Variable Statistics

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>To compute the mean and standard deviation (and more) on L_1 and L_2 simultaneously, press STAT → ▶ → ▼ → ENTER for “2-Var Stats”.</p>	<pre>EDIT [DEL] TESTS 1:1-Var Stats 2:2-Var Stats 3:Med-Med 4:LinReg(ax+b) 5:QuadReg 6:CubicReg 7↓QuartReg</pre>	<pre>EDIT [DEL] TESTS 1:1-Var Stats 2:2-Var Stats 3:Med-Med 4:LinReg(ax+b) 5:QuadReg 6:CubicReg 7↓QuartReg</pre>
<p>Press 2nd → 1 → . → 2nd → 2 to paste “L_1, L_2” onto the screen. The 2.55MP version of the TI-84 works slightly differently. Make sure that the cursor is beside “Xlist:”, then press 2nd → 1 to paste “L_1”. Press ▼ then 2nd → 2 to paste “L_2” beside “Ylist:”, then scroll down to “Calculate”. Press ENTER.</p>	<pre>2-Var Stats L1,L2</pre>	<pre>2-Var Stats Xlist:L1 Ylist:L2 FreqList: Calculate</pre>
<p>Use the ▲ and ▼ arrow keys to scroll through all of the results.</p>	<pre>2-Var Stats x̄=17.3 Σx=173 Σx²=3081 Sx=3.128720008 σx=2.968164416 ↓n=10</pre>	<pre>2-Var Stats x̄=17.3 Σx=173 Σx²=3081 Sx=3.128720008 σx=2.968164416 ↓n=10</pre>

Distributions – PROBABILITY DENSITY FUNCTION (PDF) AND CUMULATIVE DISTRIBUTION FUNCTION (CDF)

All of the functions used in the following examples are listed in the calculator’s “Distributions” menu. To access this menu, press $\boxed{2\text{nd}} \rightarrow \boxed{\text{VARS}}$ for “DISTR”.

Normal CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “normalcdf(“ and press $\boxed{\text{ENTER}}$.</p>	<pre> 0:1:1: DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:tPdf(5:tcdf(6:X²Pdf(7:↓X²cdf(</pre>	<pre> 0:1:1: DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:invT(5:tPdf(6:tcdf(7:↓X²Pdf(</pre>
<p>The command syntax is “normalcdf(<i>lower value, upper value, mean, standard deviation</i>)”. For example, if my lower value is 40, upper is 60, mean of 50 and standard deviation of 5, then “normalcdf(40,60,50,5)”. Press $\boxed{\text{ENTER}}$. For the 2.55MP version of the TI-84, fill in the entries on the screen, scroll down to “Paste” and press $\boxed{\text{ENTER}}$ twice.</p> <p>Note: If you leave out the mean and standard deviation (or leave them as 0 and 1 in the 2.55MP version), the calculator assumes z values and not actual data values.</p>	<pre> normalcdf(40,60, 50,5) .954499876 █ </pre>	<pre> normalcdf lower:40 upper:60 μ:50 σ:5█ Paste normalcdf(40,60▶ .954499876 █ </pre>
<p>To compute tail areas, you will need to enter positive infinity or negative infinity. For positive infinity type $\boxed{1} \rightarrow \boxed{\text{EE}} \rightarrow 99$, and for negative infinity type $\boxed{-} \rightarrow \boxed{1} \rightarrow \boxed{\text{EE}} \rightarrow 99$.</p>	<pre> normalcdf(40,1E9 9,50,5) .977249938 normalcdf(-1E99, 40,50,5) .022750062 █ </pre>	<pre> normalcdf lower:40 upper:1E99 μ:50 σ:5 Paste normalcdf lower:-1E99 upper:40 μ:50 σ:5 Paste </pre>

Inverse Normal

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “invNorm(“ and press ENTER.</p>	<pre> 0:QUIT DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:tpdf(5:tcdf(6:X²pdf(7↓X²cdf(</pre>	<pre> 0:QUIT DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:invT(5:tpdf(6:tcdf(7↓X²pdf(</pre>
<p>The command syntax is “invNorm(<i>area to the left of x, mean, standard deviation</i>)”. Make sure the area that you enter is the area to the left of the <i>x</i> value you want to find. Press ENTER. For the 2.55MP version of the TI-84, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p> <p>Note: If you leave out the mean and standard deviation (or leave them as 0 and 1 in the 2.55MP version), the calculator assumes <i>z</i> values and not actual data values.</p>	<pre> invNorm(.95,50,5) 58.22426813 ■ </pre>	<pre> invNorm area: .95 μ: 50 σ: 5 Paste invNorm(.95,50,5 58.22426813 ■ </pre>

Student-t Distribution CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “tcdf(“ and press ENTER.</p>	<pre> 0:QUIT DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:tpdf(5:tcdf(6:X²pdf(7↓X²cdf(</pre>	<pre> 0:QUIT DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:invT(5:tpdf(6:tcdf(7↓X²pdf(</pre>
<p>The command syntax is “tcdf(<i>lower t value, upper t value, degrees of freedom</i>)”. For example, if my lower value is -2, upper is 3 and degrees of freedom is 10, then “tcdf(-2,3,10)”. Press ENTER. For the 2.55MP TI-84 version, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p>	<pre> tcdf(-2,3,10) .9566341554 ■ </pre>	<pre> tcdf lower: -2 upper: 3 df: 10 Paste tcdf(-2,3,10) .9566341554 ■ </pre>
<p>To compute tail areas, you will need to enter positive infinity or negative infinity. For positive infinity type 1 → [EE] → 99, and for negative infinity type (-) → 1 → [EE] → 99.</p>	<pre> tcdf(-2,1E99,10) .9633059829 tcdf(-1E99,-2,10) .0366940171 ■ </pre>	<pre> tcdf lower: -2 upper: 1E99 df: 10 Paste tcdf lower: -1E99 upper: -2 df: 10 Paste </pre>

Inverse Student-t Distribution

TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “invT(“ and press ENTER. (This command only exists on the TI-84, not the TI-83.)</p>	<pre> 0:5:1:6 DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:invT(5:tpdf(6:tcdf(7:χ²pdf(</pre>	<pre> 0:5:1:6 DRAW 1:normalpdf(2:normalcdf(3:invNorm(4:invT(5:tpdf(6:tcdf(7:χ²pdf(</pre>
<p>The command syntax is “invT(<i>area to the left of t, degrees of freedom</i>)”. Make sure the area that you enter is the area to the left of the <i>t</i> value you want to find. Press ENTER. For the 2.55MP version of the TI-84, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p>	<pre> invT(.025,50) -2.008559072 █ </pre>	<pre> invT area: .025 df:50█ Paste invT(.025,50) -2.008559072 █ </pre>

Chi-Square CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “χ²cdf(“ and press ENTER.</p>	<pre> 0:5:1:6 DRAW 4:tpdf(5:tcdf(6:χ²pdf(7:χ²cdf(8:Ppdf(9:Pcdf(0:binompdf(</pre>	<pre> 0:5:1:6 DRAW 5:tpdf(6:tcdf(7:χ²pdf(8:χ²cdf(9:Ppdf(0:Pcdf(A:binompdf(</pre>
<p>The command syntax is “χ²cdf(<i>lower χ² value, upper χ² value, degrees of freedom</i>)”. For example, if my lower value is 0, upper is 19.5 and degrees of freedom is 9, then “χ²cdf(0,19.5,9)”. Press ENTER. For the 2.55MP version of the TI-84, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p>	<pre> χ²cdf(0,19.5,9) .9787383405 █ </pre>	<pre> χ²cdf lower:0 upper:19.5 df:9█ Paste χ²cdf(0,19.5,9) .9787383405 █ </pre>
<p>To compute tail areas, you will need to enter positive infinity or negative infinity. For positive infinity type 1 → [EE] → 99, and for negative infinity type (-) → 1 → [EE] → 99.</p>	<pre> χ²cdf(19.5,1E99, 9) .0212616595 χ²cdf(-1E99,19.5, 9) .9787383405 █ </pre>	<pre> χ²cdf lower:19.5 upper:1E99 df:9 Paste χ²cdf lower:-1E99 upper:19.5 df:9 Paste </pre>

F Distribution CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “Fcdf(“ and press ENTER.</p>	<pre> 0:1/x DRAW 3:invNorm(4:tPdf(5:tCdf(6:X²Pdf(7:X²cdf(8:Fpdf(9:Fcdf(</pre>	<pre> 0:1/x DRAW 4:invT(5:tPdf(6:tCdf(7:X²Pdf(8:X²cdf(9:Fpdf(9:Fcdf(</pre>
<p>The command syntax is “Fcdf(<i>lower F value, upper F value, numerator degrees of freedom, denominator degrees of freedom</i>)”. For example, if my lower value is 0, upper is 1.5, numerator degrees of freedom is 24 and denominator is 19, then “Fcdf(0,1.5,24,19)”. Press ENTER. For the 2.55MP version of the TI-84, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p>	<pre> Fcdf(0,1.5,24,19)) .8148035186 </pre>	<pre> Fcdf lower:0 upper:1.5 dfNumer:24 dfDenom:19 Paste Fcdf(0,1.5,24,19) .8148035186 </pre>
<p>To compute tail areas, you will need to enter positive infinity or negative infinity. For positive infinity type 1 → [EE] → 99, and for negative infinity type (-) → 1 → [EE] → 99.</p>	<pre> Fcdf(1.5,1E99,24,19) .1851964814 Fcdf(-1E99,1.5,24,19) .8148035186 </pre>	<pre> Fcdf lower:1.5 upper:1E99 dfNumer:24 dfDenom:19 Paste Fcdf lower:-1E99 upper:1.5 dfNumer:24 dfDenom:19 Paste </pre>

Binomial PDF and CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

<p>In the Distributions menu, scroll down to “binompdf(“ or “binomcdf(“ and press ENTER.</p>	<pre> 0:1/x DRAW 7:X²cdf(8:Fpdf(9:Fcdf(9:binompdf(A:binomcdf(B:PoissonPdf(C:Poissoncdf(</pre>	<pre> 0:1/x DRAW 8:X²cdf(9:Fpdf(0:Fcdf(9:binompdf(B:binomcdf(C:PoissonPdf(D:Poissoncdf(</pre>
<p>The syntax for both of these functions is the same. Using the PDF as an example, “binompdf(<i># of trials, probability of success, x value</i>)”. For example, if my number of trials is 10, probability is .6 and x value is 3, then “binompdf(10,.6,3)”. Press ENTER. For the TI-84 2.55MP version, fill in the entries on the screen, scroll down to “Paste” and press ENTER twice.</p>	<pre> binompdf(10,.6,3)) .042467328 </pre>	<pre> binompdf trials:10 P:.6 x value:3 Paste binompdf(10,.6,3) .042467328 </pre>

If you do not specify k , a list of probabilities from 0 to n is returned.

```
binomcdf(10,.6)
(.1048576E-4 .0...
```

The k value can be a single number or a list of numbers.

```
binomcdf
trials:10
P:.6
x value:(2,5)
Paste
```

```
binomcdf(10,.6,(
2,5))
(.0122945536 .3...
```

Let n be the number of trials, p be the probability of success, and k be the number of successes. We can compute these probabilities using the above two functions:

- $P(x = k) \rightarrow \text{binompdf}(n, p, k)$
- $P(x \leq k) \rightarrow \text{binomcdf}(n, p, k)$
- $P(x \geq k) \rightarrow 1 - \text{binomcdf}(n, p, k - 1)$
- $P(x < k) \rightarrow \text{binomcdf}(n, p, k - 1)$
- $P(x > k) \rightarrow 1 - \text{binomcdf}(n, p, k)$

Poisson PDF and CDF

TI-83, TI-84 (2.53MP AND LESS)

TI-84 (2.55MP)

In the Distributions menu, scroll down to "poissonpdf(" or "poissoncdf(" and press **ENTER**.

```
DISTR DRAW
7)X^2cdf(
8)Ppdf(
9)Pcdf(
0)binompdf(
A)binomcdf(
B)Poissonpdf(
C)Poissoncdf(
```

```
DISTR DRAW
8)X^2cdf(
9)Ppdf(
0)Pcdf(
A)binompdf(
B)binomcdf(
C)Poissonpdf(
D)Poissoncdf(
```

The syntax for both of these functions is the same. Using the PDF as an example, "poissonpdf(mean value, x value)". For example, if my mean value is 15 and x value is 10, then "poissonpdf(15,10)". Press **ENTER**. For the TI-84 2.55MP version, fill in the entries on the screen, scroll down to "Paste" and press **ENTER** twice.

```
Poissonpdf(15,10)
)
.0486107508
```

```
Poissonpdf
λ:15
x value:10
Paste
```

```
Poissonpdf(15,10)
)
.0486107508
```

Let λ be the mean value and k be the number of occurrences. We can compute these probabilities using the above two functions:

- $P(x = k) \rightarrow \text{poissonpdf}(\lambda, k)$
- $P(x \leq k) \rightarrow \text{poissoncdf}(\lambda, k)$
- $P(x \geq k) \rightarrow 1 - \text{poissoncdf}(\lambda, k - 1)$
- $P(x < k) \rightarrow \text{poissoncdf}(\lambda, k - 1)$
- $P(x > k) \rightarrow 1 - \text{poissoncdf}(\lambda, k)$

The k value can be a single number or a list of numbers.

```
Poissonpdf
λ:15
x value:(8,10,12)
Paste
```

```
Poissonpdf(15,(8,
10,12))
(.0194443003 .0...
```