WORKING WITH A DISCRETE PROBABILITY DISTRIBUTION

The following frequency distribution will be used to demonstrate using the calculator to work with discrete probability distributions.

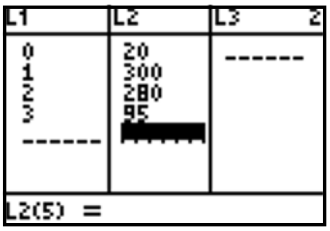
Computers	0	1	2	3
Households (f)	20	300	280	95

A. Using the frequency distribution to construct a discrete probability distribution for the number of computers per household.

STEP 1: Enter data into calculator

Enter the number of computers into L1 and the number of households into L2. To enter data remember to use ***STAT*** > ***EDIT*** (Screen 1)

Screen 1



STEP 2: Find the sum of the frequencies

Remember to exit the Edit screen by using:

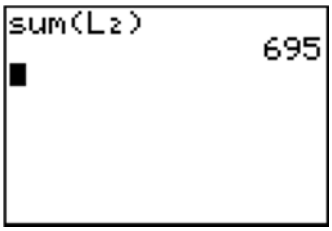
2nd – QUIT

Then take the sum of L2 by doing:

2nd > ***LIST*** > ***MATH*** > *option* ***5: sum(*** > ***L2*** > ***)*** > ***ENTER*** (Screen 2)

The sum of the frequencies is 695.

Screen 2

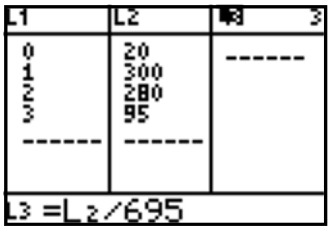


STEP 3: Create relative frequencies, i.e *P(X)*

By definition the relative frequency is given by *P(x) = f / n*. Therefore, we will use L3 to create a list of relative frequencies. Type:

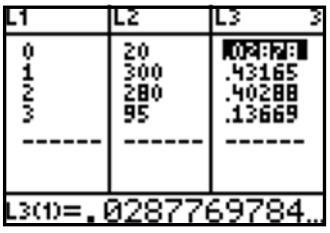
STAT > ***EDIT*** > *Highlight* ***L3*** > ***2nd*** > ***L2 / 695*** (Screen 3)

Screen 3



After hitting ***ENTER***, L3 will contain the probabilities for each value of the random variable. (Screen 4)

Screen 4



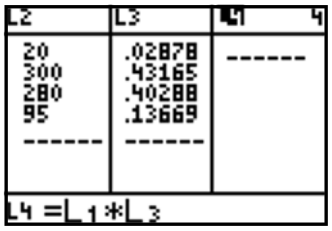
STEP 4: Find the mean of the discrete probability distribution

Using L4 we will compute the mean of a discrete probability distribution given by $\mu(x) = \sum x \cdot P(x)$.
Highlight L4 and type the following:

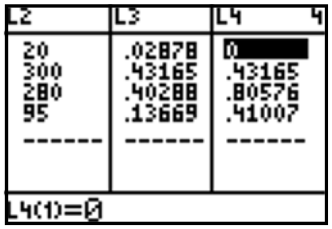
L1 * L3 (Screen 5)

Hit ***ENTER*** (Screen 6)
(Remember that the values for the relative frequencies are in L3, whereas the frequencies are in L2.)

Screen 5



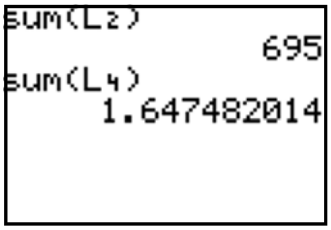
Screen 6



Now, to find the mean take the sum of L4 (Remember to use ***2nd - QUIT*** to exit the EDIT screen.) :

2nd > ***LIST*** > ***MATH*** > *option* ***5: sum(*** > ***L4)*** > ***ENTER*** (Screen 7)

Screen 7



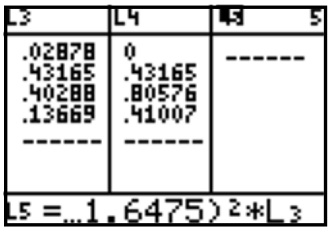
The approximation of the mean, $\mu(x)$ = 1.6475

STEP 5: Find the variance and standard deviation of the discrete probability distribution

The formula for variance is $\sigma^2 = \sum (x - \mu)^2 P(x)$. L1 contains the values of the random variable *x* and L3 contains the probability for each value (the weight). Use L5 to compute the variance:

STAT > ***EDIT*** > *Highlight* ***L5*** > ***(2nd*** > ***L1 - 1.6475)² * L3*** (Screen 8)

Screen 8

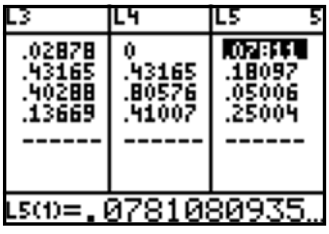


Hit **ENTER**. (Screen 9)

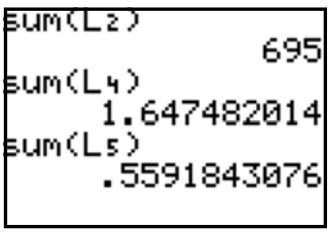
The deviations squared are now located in L5.
Now, find the sum of L5:

2nd – QUIT > ***2nd*** > ***LIST*** > ***MATH*** > *option* ***5: sum(*** > ***L5)*** > ***ENTER***

Screen 9



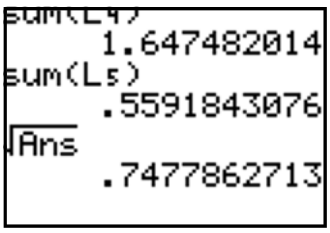
Screen 10



The variance of the discrete probability distribution is .559 computers squared. (Screen 10)

To get the standard deviation, take the square root. In this case, σ = .748 computers/household. (Screen 11)

Screen 11



B. Graphing a discrete probability distribution.

At some time, you may want to prepare a histogram of your discrete probability distribution. Use this step-by-step guide to accomplish that.

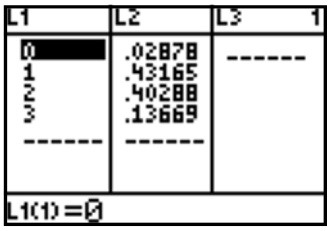
STEP 1: Enter data into calculator

From the previous example, enter the number of computers into L1 and the probabilities into L2. (If your probabilities are currently in L3, highlight L2 and type:

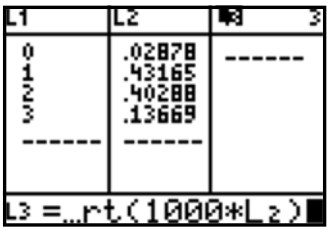
L3 > ***ENTER***

Now your probabilities are also in L2. Then ***CLEAR*** all lists except L1 and L2.) (Screen 12)

Screen 12



Screen 13



STEP 2: Round probabilities to whole numbers

The calculator (Histogram Program) has a hard time graphing with decimals, so we want to make our probabilities whole numbers. Therefore, we want to create L3 by multiplying L2 by 1000 and rounding to a whole number. To do that, highlight L3 and type:

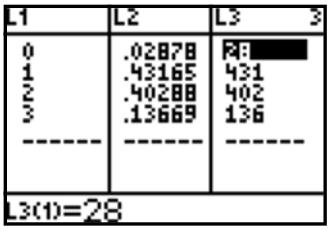
MATH > ***NUM*** > **3: iPart(** > **1000 * L2** > **)** (Screen 13)

(Note: The screen is not wide enough to show all of "iPart(1000*L2)".)

Hit ***ENTER***. (Screen 14)

L3 now contains the frequency for the random variable.

Screen 14



STEP 3: Create the histogram program

Enter the following:

2nd > ***STAT PLOT*** > ***ENTER***

Move your cursor down the screen, highlight and enter the following information as needed:

On > ***ENTER***

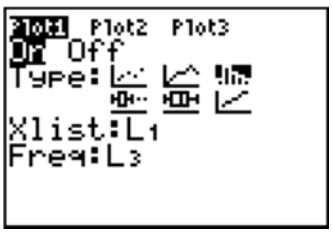
Type: histogram (top row, right picture) > ***ENTER***

Xlist : L1

Freq: L3

(Screen 15)

Screen 15



STEP 4: Set the window

Press the ***WINDOW*** button and then enter the following information:

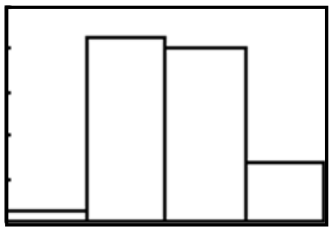
Xmin = 0
Xmax = 4
Xscl = 1
Ymin = 0 (Screen 16)
Ymax = 500
Yscl = 100
Xres = 1

Screen 16

Yscl is set to 100 since the largest denomination in L3 is hundreds.

Press the ***GRAPH*** button. (Screen 17)

Screen 17



Use the ***TRACE*** button and you will notice the number of computers in L1 is given by **min** and the frequency is **n**. (Screen 18)

Note that for **n = 28**, the probability is actually **.0287** since the y-axis has been scaled by 1000.

Screen 18