Statistics and probability- Random numbers and simulations.

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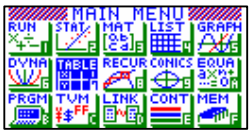
Select TABLE mode from the main menu by using the arrow keys to highlight the TABLE icon or pressing 7.

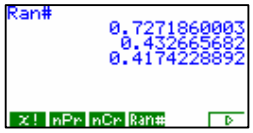


This worksheet shows how the calculator can be used to simulate random effects, how we can draw statistical graphs of these simulations. Here is an introduction to probability, in which we look at the rule of large numbers and some probability distributions using simulations. We will use the fact that the data generated can be exported from a table to a list.

Introduction

Open the **RUN**-window, and choose **OPTN**, then **F6** and **F3** for Probability. Select RAN# by pressing **F4**

Press **EXE** a couple of times, and notice what you get.



What you see is something called random numbers. These are numbers generated by the calculator in such a way that you cannot predict which number will occur next time you press the **EXE** key. In the long run, they are equally distributed on the interval from 0 to 1. **6 × Ran# + 1** gives you a random number between 1 and 6.99999999999 inclusive.

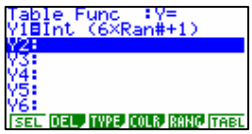
The **Integer Part** INT, which you find under **OPTN**, **NUM**, removes the decimals from the random number, leaving you with one of the digits 1 to 6.

So, Int(**6 × Ran# + 1)** can be used for some interesting experiments in probability in 6 sided dice statistics and probability.

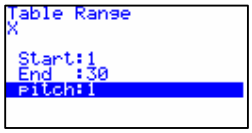
Now, in **TABLE** mode from the **MAIN MENU.**

Example 30 'rolls' of the dice.

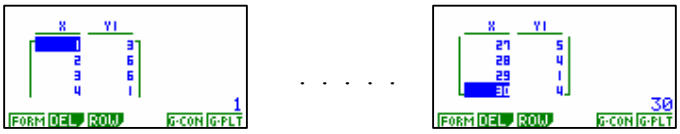
Open the **TABLE** window from the **MAIN MENU**, and enter the formula of the dice in the **Y1** space.



Set the **Range** **F5** like this. It doesn't matter that the formula does not have any X in it, it will still perform one calculation for each value of X. Press **EXIT** when you are finished.

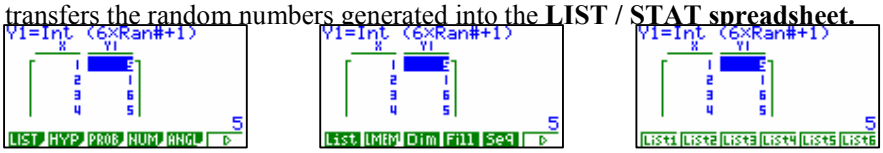


Now, press **F6** for **TABLE**, we can now see a table showing the 30 dice throws, and we will now **export** them into a list. That way we can draw a histogram of the results and calculate the summary statistics.



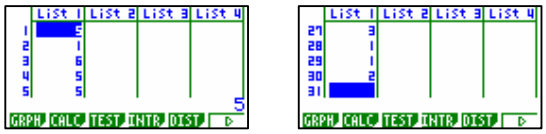
Highlight one of the numbers in the Y1-column.

Then select **OPTN**, then , **F1** for **LIST**, and **F2** for **LMEM**, and then **F1** for **List 1**. This transfers the random numbers generated into the **LIST / STAT spreadsheet.**



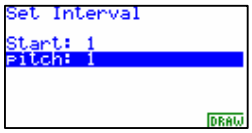
Now, you can move into the **STAT**-window from the **MAIN MENU**.

You will see the list of throws in List 1.

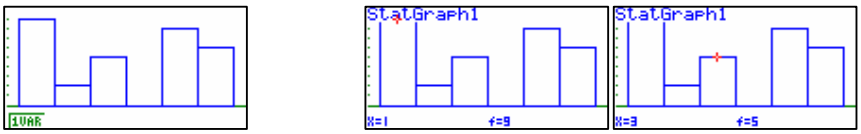


The **SET** **F6** window under **GRAPH** **F1** should look like this:

EXIT and **F1** to draw the histogram set for **GPH1**



When you draw the histogram, you can see that you probably won't get 5 results with each of the numbers 1, 2, , 4, 5 or 6. Use the trace tool **SHIFT** **F1** to find the number of 'rolls' in each case - and make a note of the result, use the → arrow to move from 'bar to bar'.



It is a good idea to repeat this experiment several times. You need to go through the steps of the experiment once again.

N.B. 1. Another experiment is to 'roll' two dice 250 times. Use the formula:

Y1 = Int(6 × Ran# + 1) + Int(6 × Ran# + 1) in **TABLE MODE**. Once you have made the experiment, and drawn the histogram, there is a challenge for you to try and explain why the histogram looks the way it does. There are lots of interesting experiments you can perform with random numbers and lists. This is just about the limitation of the calculator, since one list column cannot hold more than 255 numbers.

2. You can view the summary statistics for the simulation after the histogram is draws by pressing **F1** for **1-VAR**