A Simple Introduction to *Mathematica* for Undergraduate Research Projects

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Preface

This book is written especially for the students of MATH 3120 and 3130 at Austin Peay State University in Clarksville, TN, but we hope it reaches a wider audience.

If you have never programmed before...

This pamphlet assumes you have done at least a little programming before, possibly in C, C++, FORTRAN, Visual Basic, or some other language. If not, *that is completely fine.* We will walk you through a little basic programming here so that you can get your feet wet, and then you will be ready to take on chapter 1!

CHAPTER 1

A Review of Some Stuff You've Probably Seen Before

Before beginning this chapter, it is assumed that you know a few things about programming already. Specifically, you will need to know how to

(1) assign values to variables
(2) evaluate *Mathematica* cells

and if you don't, that's quite alright. Just see the section "*If you have never programmed before...*" on page vii, and even if you have done a bit of programming before, we will walk you through some basic *Mathematica*.

1. Variable Assignment

The first thing we need to know in any language is how to assign variables. Probably you are thinking "*I learned this in CSCI 1010!*", but *Mathematica* is a subtle language, and does not always work as you might expect if you are coming from C++ or FORTRAN.

```
i = 1;
j := 2;
k = 3
l := 4
```

Looking at this example, we can see that there are four slightly different ways to "assign" values to a variable, so let's discuss this a bit. If you put this code into a *Mathematica* cell, you will see that, upon evaluating the cell,

APPENDIX A

Finding Help on the Internet

1. Stack Overflow

One of the greatest resources for *Mathematica* help on the internet is StackOverflow/Mathematica. Also becoming very popular is mathematica.stackexchange.com, which is a separate site dedicated enitrely to *Mathematica* issues. Both of these should serve you well in your quest to find answers to your problems.

StackOverflow is a forum in which users are encouraged to give insightful answers in order to receive *points*, which amount to social capital. Thus, the answers you will find on StackOverflow are consistently of a higher quality than those you will find on other programming-related websites.

On StackOverflow, all questions are *tagged* according to which programming language or platform they pertain to. The link above will take you directly to the *Mathematica* questions, and from there you can search for more specific information about your question.

Generally, the probability that the issue you have run into when programming in *Mathematica* (or any language) is unique is very low, so the odds are in your favor that someone has encountered a very similar problem before you. Thus, the challenge is to alter your search terms judiciously until you stumble on a problem that seems to fit the issue you are dealing with.

One way to help with this process is to speculate a few guess about what the problem might be. For example, are you using some functions whose behavior you don't quite understand? Maybe you getting a weird output that doesn't look like what you think it should? Searching on StackOverflow for things like "ListPlot no graph" is more likely to get you useful results than "no graph".

1.1. Asking Questions on Stack Overflow. Accounts on StackOverflow are free, and joining this community will help you learn a great deal about both *Mathematica* and programming in general. Searching through other people's questions and the suggested answers can be very informative, and it is a good intellectual exercise to try to solve some on your own (and you may even be rewarded with profile points!).

Of course, membership on StackOverflow also allows you to post questions. Understand though that the community expects you to have done some work before you post a question. Generally, before posting new questions, it is advisable to:

(1) Try your query on a major search engine like Google or Bing. At least try all the links on the first page to see if they have anything helpful to offer.
(2) Try searching WolframAlhpa. While this is not exactly a search engine in the usual sense, its results usually contain *Mathematica* code which is occasionally helpful.

(3) Try the *Mathematica* documentation. You can access this by pressing Shift+F1 while running *Mathematica*. Specifically, you will want to look at the examples that are available on the documentation page for each function that you might have questions about. Frequently functions can take different arguments, or give different output depending on parameters or options, so it may be that you need to invoke your function in a slightly different way.

If you have done these things and still not found the answer to your question, then it will be cool to post your question on Stack Overflow. One thing to note is that while people on Stack Overflow are usually very eager to help, they need enough information about what you are trying to do to be able to understand where you might be running into trouble. Generally, posting a single line of code may not be enough. Also, keep in mind that folks on the internet are very unlikely to be familiar with your research, so it is important to track down the issue as specifically as possible.