

APM 153 LECTURE SIX – Course Website, Mfiles, Documentation, Help Files, Calculating a Quadratic Equation, More on Algorithm Development.

Course Website

- (1) Dr. Gary Scott, the previous instructor of this class maintains a course website for APM 153. <http://www.esf.edu/pse/scott/class/apm153/apm153.html>
- (2) The website contains Adobe Acrobat pdf files of all the handouts (syllabus, lecture notes, and assignments) that have been handed out in class so far.
- (3) As I write new lecture notes and assignments I will post them to the website.
- (4) If you miss class or lab, you should go to the website and download the materials you missed.

Mfiles and Script Files.

- (1) Mfiles are the files in which we write programs in Matlab. Mfiles can be either script files or functions. For assignment three we will be writing a script file. Mfiles are written and edited in the mfile editor.
- (2) You can open the mfile editor by either clicking on the white page icon on the Matlab toolbar, or by clicking on the name of a script file or a function listed in the Current Directory window.
- (3) A script file consists of a series of matlab commands, but because some of these commands may be several lines long, it is more convenient to write them into a script file.
- (4) Script files are also more convenient to use because you write the program once, and then you can use it over and over.
- (5) As you write and edit a program, don't forget to save your changes before you try running the program again.

Comments and Documentation

- (6) You can write comments into Matlab programs using the % symbol.

(7) Most comments begin on the first column of the program, but you can add a comment anywhere in the program as in the two examples below.

```
% This comment starts on the first column
```

```
if discriminant == 0           % This comment starts after a line of code.
```

(8) Matlab ignores comments. They are not active lines of code. Instead, they are put into the program for us to read.

(9) Comments include all the documentation you need to put into your program to tell another person everything they need to know about the program, such as who wrote it, what the program does, what the variables means, and what specific portions of the code do.

(10) We generally break documentation into the following categories.

- | | |
|------------------|--|
| Description | - Explain what the program does and how it does it. |
| Name, Date, etc. | - Explain who wrote the program, when the program was written, and any other information such as your course number. |
| Dictionary | - An alphabetical listing of all the variables used in the program. Variable names are supposed to be short and easy to understand, but it really helps to spell it out for the user what each variable is supposed to represent. |
| Section Headers | - These headers let the user know what each section of code is supposed to do. |
| Line Comments | - These comments are added as necessary to explain individual lines of code. These are particularly useful for you to add to explain to yourself what each line of code is doing. |

Adding a “Help File” to Your Programs

(11) In addition to helping someone read your code, the comments you type into your program can be used as an instant “help file” by someone wanting to know what your program does.

(12) The first line of both script files and functions contains the name of the program.

(13) The second line of a Matlab program is known as the **H1 Comment Line** and should contain a one line summary of what the program does. For example,

```
% Script file: calc_roots.m  
% calculates the roots of a quadratic equation
```

(14) If you type help calc_roots in the Matlab Command Window, you would see,...

```
>> help calc_roots  
Script file: calc_roots.m  
  
calculates the roots of a quadratic equation
```

(15) In fact, Matlab will print out every comment starting with the H1 Comment line until either a blank line (no comment) or a line of active code is reached.

Calculating a Quadratic Equation

(16) The solution to a quadratic equation where $ax^2 + bx + c = 0$ is given by the formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

(17) Because of the “±” sign in the equation, there must be two answers or “roots” to the equation.

(18) The Matlab program on pages 106 – 107 in your textbook use a clever method to calculate what **kind** numbers the roots will be for any given set of coefficient.

(19) The calc_roots program first calculates the **discriminant** and then based on the value of the discriminant, tells us whether the roots will be real or complex.

if discriminant > 0	there are two real roots.
if discriminant = 0	there is one repeated real root
if discriminant < 0	the roots are complex

(20) What do we mean by **complex**? Complex numbers consist of a real number and an imaginary number. Imaginary numbers of course refer to the square root of a negative number.

(21) We all know you can't take the square root of a negative number, but often this type of number occurs in certain types of math. When we have a calculation with the square root of a negative number, we say that the answer is an imaginary number.

(22) The simplest imaginary number is $\sqrt{-1}$. which we symbolize as the letter "*i*".

(23) The simplest complex number therefore is represented as $0 + i$

(24) In this case, the 0 represents the real part of the complex number and the *i* represents the imaginary part.

(25) Matlab has some problem writing imaginary numbers out using the fprintf command, so the program calc_roots side-steps this problem by calculating the imaginary part as a real number alone using the **abs** command. What do you think the abs command does?

(26) Review the tables on 75, 76, and 77 to see review some of the most important commands in Matlab. For example, you have already used the operators `.*`, `.^`, and `\` in assignment one, but do you **know** what they do?

(27) Bring your working calc_roots.m program to lab on Friday.

More on Algorithm Development

(28) Have you been keeping up with your reading? Let's see.