Numerical Analysis

Worksheet 5: **Wednesday September 15**

SUMMARY Introduction to MATLAB
CURRENT READING Recktenwald (Chapter 2), pp. 15-84

Introduction to MATLAB
MATLAB is an interactive numerical computing environment. It allows both command-line instructions, and programs, which are placed in files ending with `.m`.

Our goal is to take this week to become introduced to, and proficient with, using MATLAB . I would like you to read and be able to use the commands found in Chapter 2 and Sections 3.1, 3.2, 3.3 and 3.4 of the textbook.

We will be using files from the `NMM` toolbox, which should be found in
`S:\Math Courses\Math370` directory. Of particular interest to us will be the `data`, `interact` and `program` directories.

MATLAB **Help**
You can use the command **help** *command* to get information on the command *command*. MATLAB is **not case-sensitive**.

You can use the command **lookfor** *string* to search the list of MATLAB commands for occurrences of the word *string*.

MATLAB **Skills Checklist**
We want to be able to do a number of things using MATLAB by the end of this week. NOTE: This list is not exhaustive, even if some of you may think it is exhausting!)

- ☐ Use MATLAB as a calculator

- ☐ Use built-in functions and variables (e.g. `sin()` and `pi`)

- ☐ Define and use user-defined MATLAB variables

- ☐ Use the semi-colon to suppress output

- ☐ Use the comma to type more than one command per line

- ☐ Create vectors and matrices

- ☐ Apply mathematical operations to vector and matrices

- ☐ Use Matrix subscript notation (i.e. `M(1,2)`)

□ Use the `linspace` and `logspace` operators

□ Use the **Transpose** operator '

□ Use the colon operator :

□ Use the `disp` command for simple output

□ Use `fprintf` for more sophisticated output (recognize format codes)

□ Able to plot functions, with labels, titles, and added text

□ Understand the key differences between functions and scripts

□ Able to edit and run m-files (functions and scripts)

□ Modify existing m-files to produce desired output

□ Save m-files to disk and run m-files from disk

Try to generate the following figures of $y = 10e^{-2x}$ on $[0, 3]$ using a standard and a semilog scale.

Scripts
Scripts are just files which contain sequences of interactive MATLAB commands. Scripts do not have input or output parameters. Variables used in scripts affect the variables in the MATLAB variable space.

Functions
Functions are MATLAB subprograms similar to subroutines found in programming languages `C` or `Fortran`. Functions can use both global variables and local variables. Functions can have multiple inputs and outputs.

Functions have features scripts do not have. Scripts have no advantages over functions. Use functions, not scripts!
Examples
Look at the files `trigplot.m`, `myCon.m`, `threesum.m`, `addmult.m` and `twosum.m`. Which of these are **script** files and which of these are **function** m-files?
Let's run each one and also look at them and insure that we understand what each one does.

This is a figure containing 4 subplots which show different surface plot types of $z = 2 - x^2 - y^2$ on the domain $-5 \leq x \leq 5, -5 \leq y \leq 5$ on this page.
The commands are:

```
>> x=linspace(-5,5,20);
[X,Y] = meshgrid(x,x);
>> Z = 2 - X.^2 + Y.^2;
>> subplot(2,2,1); mesh(x,x,Z); title('mesh plot');
>> subplot(2,2,2); surf(x,x,Z); title('surf plot');
>> subplot(2,2,3); surfc(x,x,Z); title('surfc plot');
>> subplot(2,2,4); surfl(x,x,Z); title('surfl plot');
>>
```