Department of Engineering Technology
Washkewicz College of Engineering
Cleveland State University

GET 315 Advanced Programming Methods
Spring 2020
Computer Project 10

Introduction:

The early part of this course focused on C programming where we investigated a number of mathematical relationships and wrote the C code necessary to perform those operations in lieu of having to do them manually. Although MATLAB® offers many internal functions (and additional packages that contain some fairly sophisticated and complex mathematical models), it still does not offer solutions to every possible engineering or scientific problem. However, MATLAB is extensible through programming permitting one to create new functions.

As we discussed, MATLAB offers a scripting capability where a program, in the style of C, can be written as function or standalone code with inputs and output statements.

This assignment explores the students ability to use MATLAB programming to create either additional functions or stand alone program code.

MATLAB Input/Output:

MATLAB programming has many of the same file input & output statements used in C, such as 'fscanf', 'sscanf', 'fprintf' and others. Although 'scanf' & 'printf' are not part of the MATLAB language; however, their equivalent commands, 'input' & 'disp', respectively, are.

The format of the 'input' command is

```
    var = input('prompt');
ex. x = input('Enter value of x: ');
```

In the example, the user will be prompted to enter a value(s), which will be assigned to the variable *x*. The value will be entered on the same line as the prompt; the prompt can be extended to multiple lines by using the '\n'. To enter a vector/array, you type the values in the same manner used in the 'Command Window'. Note that any MATLAB function can be used while entering values at the prompt

The format for the 'disp' command is

```
    disp(var);
ex. disp(x);
```

The command will display the value(s) of *x* in the default format. If a different format is desired, the 'format' command can be used to change the output

```
ex. format shorteng, x;
```

```
disp(x);
```

In the above sequence, the value of *x* will be shown as #.####e+###
The following formats are valid to use in the 'format' command -

SHORT, LONG, SHORTE, LONGE, SHORTG, LONGG, SHORTENG, LONGENG, HEX, +, BANK, & RAT

Note that the 'format' command actually changes the output for all the commands that follow

Assignment:

Use a MATLAB script to write either a user defined function or a standalone code to perform the following operations:

1. Write a MATLAB function that calculates the amount of radio active material, *A*, at time *t* using the following relationship

$$A(t) = A_0 e^{-kt}$$

where A_0 is the initial amount at $t = 0$, and k is the rate of decay which can be determined from the radio active material half-life value

The function accepts the following arguments – A_0, the half-life, & t; and returns the following output – 'The amount of radio active material after ## years, is ## kg'. Test your function with determining the amount of plutonium-239, that has a half-life of 24110 years, left after 1000 years if the initial amount is 50 kg

2. The altitude can be determined by measuring the temperature of boiling water using the following equations

$$T_b = 49.161 \ln|p| + 44.932 \quad \text{and} \quad p = 29.921(1 - 6.8753\text{e-}6\,h)$$

where T_b is temperature of boiling water in °F, p is the atmospheric pressure in inches of mercury, & h is the altitude in ft

Write a MATLAB script that generates a two column table with proper headings showing the altitude (h) in one column and the temperature (T_b) in the second column. Use a range of -500 ft to 10,000 ft for h in increments of 500 ft. Hint, to display the table, generate a two column vector, one column contains the h values, and the other contains the T_b values

Write up Requirements:

Your report must include at minimum the following -

- A single document with a title page that includes the following information

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Spring 2020
CSU-ID: <your csu-id>

Computer Project 10
Due Date: <date>

- For each code include comment lines (%) that explain what the line(s) that follow are
- A printout of MATLAB codes and a screen capture of the session showing the entered commands and responses for each question