EGR 141: An Introduction to MATLAB

Summary: The goal of this lab is to get introduced to the basic calculator-like functionality of MATLAB, learn how to created formatted output, and get used to getting input from the user.

- Create a script by clicking the *New Script* icon in the upper left corner of the MATLAB window.
- In the resulting editor window, click Save -> Save As... and save your file as *Lab1_yourName.m*
- Make the first line of your script: *clear; close; clc;*
- To run your script and verify your output is correct, click the Run button in the upper middle of the editor window
- Inside your script, solve each of the given problems. In between each problem, type *pause;* Clearly indicate where the code for each problem begins by using a comment block. Start each new problem with a *clear .*
- On this, and all labs, it is likely that you will have to look up some formulas or mathematics. I assure you that you have seen all of this math before, but it has probably been a while. You are welcome to look up mathematics formulas and problem-solving techniques, but make sure you do not look up code and violate the plagiarism policy.
- If my example output "lines up nicely" then your output should as well.
- All output statements should output variables, not pre-computed constants. For example, if I ask you to output $r/2$ when $r = 3$, then you should set r to be three then output as *fprintf(' r/2 = %f ',r/2);* and not *fprintf('r/2 =1.5')* or *fprintf(r/2 = %f',3/2)*.

1. There are many common formulas that approximate π. For example, $\frac{22}{7}$ is often used as a rational approximation. Find two formulas that approximate π to at least 4 decimal places but are not exactly equal to π. Each formula should have *at least two* of the following (and standard 4 math operations): a root, a log, an exponential, an integer power, or a factorial. Print your formulae as well as your approximations to the screen using 17 decimal places. Include a link in your comments showing where you found the formulas. Unfortunately, you cannot use the two formulas shown in example output.

```
Lab 1 - Approximation of Pi
My approximations to pi are:
     2^(5^.4)-.6-(.3^9/7)^(.8^.1)=3.14159265359045348
        (2-sqrt(2*sqrt(2)-2)/4)^2=3.14159697417218231
                  MATLAB pi approx=3.14159265358979312
```

2. Prompt the user to enter in an integer, n, then output the integer part of Stirling's approximation to *n!* (n factorial)

$$\sqrt{2\pi n}\left(\frac{n}{e}\right)^n \approx n!$$

as well as MATLAB's built in result. Output 30 digits, if needed.

```
Lab 1 - Stirling's Formula
 Calculator for n!
 Enter in an integer:4
  Stirling's Approximation is 24
            MATLAB's result is 24
```

3. Your grandmother gives you a \$100 savings bond when you turn 5. The bond grows at $r\%$ per year, compounded continuously. Set and output each of the following variables

   (a) *ten* is the value of the bond when you are ten years old (output two decimal digits only)

   (b) *twenty* is the value of the bond when you are twenty years old (output two decimal digits only)

   (c) *age*339 is the age you'll be when the bond is worth \$339.88 (round down to nearest integer year)

   Set r to be the one fifth the sum of the numbers corresponding to your first and last initials. For example, if my initials were JB, then $J = 10$ and $B = 2$ so my rate is $\frac{12}{5}\% = 2.4\%$. Output all of your results nicely formatted to the screen.

```
Lab 1 - Grandma's Savings Bond
 Starting at $100.00 with a rate of  2.40%
  When 10 years old: $112.59
  When 20 years old: $142.72
  You will have $339.88 when you are 56 years old
```

4. Two sides of a triangle are $a = 8$ in and $b = 9$ in . The measure of the angle between the two sides is C. Ask the user to enter in the angle, C in *degrees* . Then set and output each of the following variables

   (a) c is the length of the third side (in inches)

   (b) B is the angle opposite side b (in degrees)

   (c) A is the angle opposite side a (in degrees)

   (d) *area* is the area of the triangle (in square inches)

   Note that negative output is possible, as a user may enter in any angle. Use two decimal places for all output.

```
Lab 1 - Triangle Calculator
 What is the the angle (degrees) b/t sides a=8 and b=9? 33
     c = 4.92 inches
     B = 84.73 degrees
     A = 62.27 degrees
  area = 19.61 sq inches
 What is the the angle (degrees) b/t sides a=8 and b=9? 188
     c = 16.96 inches
     B = 4.24 degrees
     A = -12.24 degrees
  area = -5.01 sq inches
```