ECE 201: Introduction to Electrical Engineering II
Prof. B.-P. Paris
Lab 3: Programming in MATLAB

The objective of this lab is to write a Matlab script M-file that implements the functionality described below. Store your program in a file named `Lab3.m`.

1. The program starts by presenting the user with the following menu of options:

   ```
   Choose from the following menu:

         Enter complex number in polar form       (1)
         Enter complex number in rectangular form (2)
         End program                              (0)

        Choice (0, 1, 2)? :
   ```

   Read the user's input and proceed according to his choice. Should the user enter anything other than `0`, `1`, or `2`, display an error message and redisplay the menu.

2. If the user selects `0`, end the program.

3. If the user selects `1` or `2` proceed as follows. Begin by prompting the user for two complex numbers.

   - If the user selected option `1`, begin by prompting the user if he prefers to enter the phase of the number in degrees or radians. The corresponding menu might appear like this

     ```
     Enter phase in

           degrees   (1)
           redians   (2)

     Choice (1, 2):
     ```

     Allow the user to continue from this dialog only after he selected either `1` or `2`.

     Proceed to prompt the user for the magnitude and phase of the first complex number. Check that the magnitude is positive. Construct a complex number `C1` from the user's input. Be sure to interpret the phase according to the preference expressed by the user. Don't forget to convert to radians if the user indicated a preference for degrees. Display the complex number `C1` in rectangular coordinates, e.g., display a line like

     ```
     C1 = x + j y
     ```

     where `x` and `y` are the the real and imaginary parts of `C1`.

     Prompt the user for a second complex number and store it as `C2`. Ensure that `C1` and `C2` are different. Display the number C2 in rectangular form.

   - If the user selected option `2`, prompt for the real and imaginary parts of the first number and store the result as variable `C1`. Repeat for a second complex number to be stored as `C2`. Ensure that the two numbers are not identical.

     Prompt the user if he prefers the results in polar form to show the phase in radians or degrees. The corresponding menu might look like this

     ```
     Show phase in

           degrees   (1)
     ```

```
    redians   (2)

Choice (1, 2):
```

Allow the user to continue from this dialog only after he selected either `1` or `2`.
Compute the magnitude and phase of each of the two numbers and display the result like this

```
C1 has magnitude r1 and phase phi1
C2 has magnitude r2 and phase phi2
```

where `r1`, `r2`, `phi1`, `phi2` are the magnitudes and phases you computed.

4. Compute `C3 = C1+C2`.

5. Plot the complex numbers `C1`, `C2` and `C3` in the complex plane. In other words, plot the real parts against the imaginary parts and label the axes `Real` and `Imaginary`, respectively. Use a red circle to plot `C1`, a blue square to plot `C2`, and a black diamond for `C3`.

6. Construct the vector `nn` with elements from 0 to 20 with an increment of 1. Then, compute a second vector `y` with elements equal to `C3.^nn`. Use the following command to plot `y`:

   ```
   plot(y)
   xlabel('Real')
   ylabel('Imaginary')
   grid
   ```

   Explain what you see.

7. Return to the beginning prompt so that the user can choose a different pair of complex numbers.

For your final report, turn in your well-commented Matlab program `Lab3.m`. Attach a plot that shows `C3.^nn` with an explanation of what you see. Also, execute your program once while capturing output to a diary file and attach the diary file.

The report is due one week after this lab.