Lab Assignment #1

Due 1/29/2016 at 4pm on bCourses

To complete the lab, follow all the instructions below step by step and submit the portions requested in part 4 below. For questions 1 and 2, you will use the template `Lab1_Template.m` provided with the assignment and fill in the appropriate values. It is important that your variable names are exactly what they are supposed to be (variable names ARE case sensitive). For this lab you are given a template to start with, but in the future you will need to make your own. Before you start working, rename the template file to be

`<Firstname>_<Lastname>_Lab1.m`

For example, if your name is Bradley Harken, your file should be named

`Bradley_Harken_Lab1.m`

1. Using MATLAB as a calculator

   (a) Define variables $a = 3$; $b = -6$; $c = 4$; and $x = 2$.

   (b) For each of the quantities E_1 through E_{10}, construct a one-line MATLAB expression that computes the value and assigns it to a variable. Your assignments should give appropriate values for E_1 throught E_{10} regardless of the values of a, b, c, and x (i.e. you should use the variable names instead of their numerical values). In MATLAB, we will use variable names `E1` through `E10` to store the values E_1 through E_{10}. Definitions of the variables `E1` through `E10` have been started for you in the template.

   i. $E_1 = \sqrt{a^2 + b^2 + c^2}$
   ii. $E_2 = \frac{-b-\sqrt{b^2-4ac}}{2a}$
   iii. $E_3 = \ln(3x - a)$
   iv. $E_4 = \log_{10}(3|b| + \frac{c}{5})$
   v. $E_5 = (ax + \frac{ab}{c})^{1/3}$
   vi. $E_6 = \frac{x^2+1}{(ax-1)\lvert b-e^x\rvert}$
   vii. $E_7 = (\cos(\frac{\sqrt{a}}{3}\pi))^2 + \cos((\frac{\sqrt{a}}{3}\pi)^2)$
   viii. $E_8 = e^{\pi\sqrt{-1}}$
   ix. $E_9 = \arccos(\cos(x))$
   x. $E_{10} = \frac{a+2c}{\sin(\frac{b+2c}{\sqrt{a^2+b^2+c^2}})}$

2. In this question you will be plotting the number of wins and losses by the Cal Football team from 1886–2015.

   (a) The table shows the win-loss record for the Cal football team from 2007-2015. Create three variables in MATLAB: `Year`, `Wins`, and `Losses`, containing data from the corresponding columns in the table. You can save yourself some typing using the shortcut of `2007:2015` to define `Year`. When you are done with this step, each variable should be a vector (1-D array) containing 9 data points.

Year	Wins	Losses
2007	7	6
2008	9	4
2009	8	2
2010	5	7
2011	7	6
2012	3	9
2013	1	11
2014	5	7
2015	8	5

(b) The correct number of losses in 2009 should be 5, not 2. Correct the 3rd entry of the losses data array to 5. You can manually reassign `Losses(3) = 5` without retyping any of the other data.

(c) The file `CalFB_HistoricalData.mat`, which is available on bCourses, contains wins and losses data (as well as other data) for the years 1886–2006. Load this data (use the command `load`) and create variables which contain all data from 1886-2015. The file contains variables `Y` for year, `W` for wins, and `L` for losses. You need to create new variables `Y_all`, `W_all`, and `L_all` using both the variables loaded from the file and the variables you already defined.

The commands `size` and `who` might be helpful. Pay attention to the number of rows and columns when you're concatenating. The source of this data is here.

(d) Plot wins and losses for the years 1886–2015 using the variables `Y_all`, `W_all`, and `L_all`. Use the MATLAB command `help` to learn about the commands `plot`, `xlabel`, `ylabel`, `title`, `legend`, and `axis`. Construct and modify a plot in steps as you read about each command. Choose a different color and line style (solid, dashed, dot-dashed, etc.) for showing `Wins` and `Losses` data. Add a legend box, and adjust it as necessary so it does not cover up the data. The vertical axis on your plot should be set to range from 0 to 15.

(e) Add text to your figure with your name, SID, lab section number, and name of your GSI. For information about how to do this, type `help text` into MATLAB. Copy and paste your figure to a separate file which can be converted to a pdf (e.g. a Word document). You will add more figures to your file in the next question.

3. Here, you will get your first taste of writing a full computer program using a high-level block-based computer language called Scratch. (See `http://scratch.mit.edu` for more info if you're curious.) You will follow a tutorial which will teach you what to do, and at the end you'll be able to create something on your own. (Technically, this tutorial uses a language called Blockly, which is very similar to Scratch. We will actually use Scratch next week.)

(a) First, watch this video with Mark Zuckerberg explaining how loops work:
`https://www.youtube.com/watch?v=mgooqyWMTxk`

(b) Now watch this video with Bill Gates explaining how `if` statements work:
`https://www.youtube.com/watch?v=m2Ux2PnJe6E`

(c) Complete the Hour of Code Artist activity found here (you will need to sign up):
`http://studio.code.org/join/TXLHDX`
Follow the steps (in sequence) to complete parts 1-8 of the Artist activity. If you need to see the instructions for an exercise again, click in the lower left part of your browser window. If you feel stuck, test out your code by hitting `Run` (in the lower left) and look at the tips or hints provided.

(d) In part 9, modify the code to create a grid of triangles instead of hexagons. The triangles should all be touching but not overlapping, so you will need to figure out the distances you need to move, etc. (There are several possibilities - just make sure your final result is a grid of triangles that are all touching but not overlapping.) Take a screenshot of your final image. Add this screenshot to the file with the figure from the previous question. **The screenshot shold show the entire browser window, including the work area, the picture, and the block code.**

(e) Click on the purple button that says "Show Code" to see the source code written in JavaScript (note what it says at the top of the pop up window!). This is all code that you wrote!! JavaScript uses different syntax from Matlab (which we are in the process of learning) but you should still be able to get the general idea.

(f) In Part 10, use what you learned to create your own unique design. You should use one function and at least one repeat block. Take a screenshot of your final browser window (showing the final result and the block code) and add it to the file with the other two images.

(g) When you're done, feel free to explore other Hour of Code modules!

4. **Submission Instructions:** When you have added all 3 images, convert the file to a .pdf file and name it:

`<Firstname>_<Lastname>_Lab1pics.pdf`

So if your name is Bradley Harken, then your file should be named

`Bradley_Harken_Lab1pics.pdf`

When you are finished with the assignment, upload both the MATLAB script (the .m file) and the pdf file with your 3 images (the .pdf file) to bCourses under Lab Assignment 1.

Note: to create a screenshot of your browser window, do the following

- On Windows: Search for the program "Snipping Tool" and open it. Click "New" and then your mouse to select a rectangle to capture in your picture. Then click Edit then Copy. The captured image can now be pasted into any application.
- On a Mac: shift+command+3 will create a .png file on your desktop with a screen capture of your entire screen. shift+command+4 will allow you to drag your mouse to define the area of the screen capture. `https://support.apple.com/en-us/HT201361`