ELEE 4200/5200: Autonomous Mobility Robotics
Term I, 2018
Homework 0: MATLAB Assessment

Note:

- The aim of this assignment is:
  - To assess MATLAB skills *after* completing the tutorial exercise that you were asked to complete.
  - To specifically execute an exercise that will connect later to plotting the path of a differentially-steered robot from wheel encoder readings.
- Guidelines:
  - Due date: Thursday, September 13, 2018 by 12 Noon.
  - You are permitted to work in groups of no more than two students. State the full names and T# of the students in the group on the cover page of every document that you submit.
  - Submit the report by responding to this assignment posting in Blackboard.
  - The submission should at least include the following documents, bundled together into a single zip file with the name *YourNameHW0* (use one of the group member names).
    - The main report (following the template provided).
    - The main report in 'pdf' form.
    - The MATLAB program code.
  - A hard copy (printout) of the 'pdf' report with MATLAB code; staple all pages together and follow the TA's instructions on how to submit.
  - Each group must work on its own in completing this assignment! Feel free to consult with others in developing solution ideas, but the final implementation code must be your work product alone. Refer to the Syllabus, where the policy on academic integrity is clearly outlined, our classroom discussion on this topic, and consult with me if you have any questions!

Write a self-standing MATLAB program (in the form of an m-file) that plots a version of the circles making up the Olympic rings (see Figure 1 below). Use the parametric form of a circle (discussed later in this document) to generate and plot the circles. The calculation of points on the circle should be carried out in a MATLAB function, which has as input the information about the center and radius for one circle at a time. The plotting should be done in your main program.

For each circle, the radius should be calculated from the following equation:

$$radius = 3 * scale$$

where *scale* should be a random number in the interval [0,1].

The center and radius information should be stored in variables entitled 'center' and 'radius'. The 'center' should be a matrix with number of rows equal to the number of circles to be plotted, and two columns for the coordinates of the center (x_o, y_o). The 'radius' should be a row vector with the radius of the circles. Also store the values for each 'scale' value in a row vector called 'scales'.

Construct the program so that one circle at a time is computed and added to the plot.

The references [1-3] below contain information that will be helpful in completing this homework!

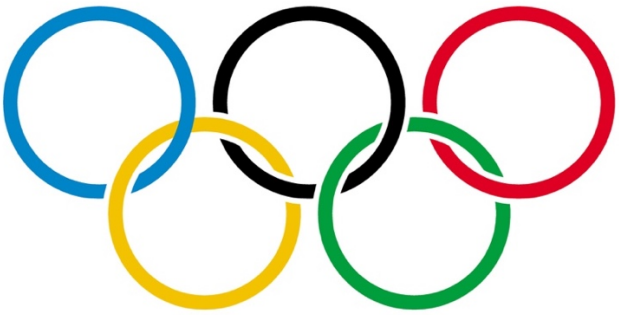

Figure 1: Olympic Rings (public domain)

Parametric form of a circle [3]

$$x = x_o + R * cos(\theta)$$

$$y = y_o + R * sin(\theta)$$

where (x_o, y_o) is the center and R is the radius.

This is called a "parametric form", because the value of the parameter, θ, drives the calculation of pairs of (x, y) values. In the equations above, obviously $0 \leq \theta < 2\pi$.

Refer to [3] for details – my symbols above are different from the ones used in the reference!

References

1. Using functions in MATLAB:
   https://www.mathworks.com/help/matlab/matlab_prog/create-functions-in-files.html

2. The suggested MATLAB tutorial:
   https://matlabacademy.mathworks.com/R2018a/portal.html?course=gettingstarted

3. Parametric Equation of a Circle:
   http://www.mathopenref.com/coordparamcircle.html