CS1112 Fall 2012 Project 2 Part B   due Thursday 9/20 at 11pm

You must work either on your own or with one partner. If you work with a partner you must first register as a group in CMS and then submit your work as a group. *Adhere to the Code of Academic Integrity.* For a group, "you" below refers to "your group." You may discuss background issues and general strategies with others and seek help from the course staff, but the work that you submit must be your own. In particular, you may discuss general ideas with others but you may not work out the detailed solutions with others. It is not OK for you to see or hear another student's code and it is certainly not OK to copy code from another person or from published/Internet sources. If you feel that you cannot complete the assignment on you own, seek help from the course staff.

Objectives

Completing this project will solidify your understanding of Chapters 2 and 3 in *Insight* (`for`-loops, `while`-loops, nested loops).

Note: Do not use arrays. You will call several provided functions, but do not create your own functions in this project. In order to call the provided functions, put them in the same directory/folder as the script that calls these functions.

Project 2 Part A (question 1) appears in a separate document.

2   What time is it?

Write a MATLAB script `clockFace` to display a time (e.g., 23:15:31) on a clock with hour and minute hands. (Make a still display, not a running clock.)
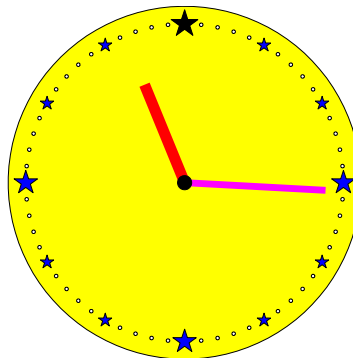
The clock is drawn in a figure window. Our clock's hands have a "continuous pivot," i.e., they are not restricted to the 60 individual minute marks. The hour value may be any whole number in [0..23] and the minute and second values are whole numbers in [0..59]. There are quite a few things that the solution will need, so practice *problem decomposition*. Here are some "subproblems" that you need to solve in order to complete the solution; work on them one at a time: convert numeric time values to angles, convert angles to x-y coordinates for plotting, draw the clock with tick marks, and draw the hands to indicate the time correctly. First, *structure* your solution by writing a comment for each task in the provided skeleton script `clockFace` in a logical order. Then fill in the detail (add code) under each comment. *Test* each newly added section of code simply by running the (partially completed) program. (Later in the course we will discuss a better strategy for testing and program development.) Keep in mind that some tasks may appear in multiple parts of the script (e.g., converting an angle to x-y coordinates for plotting). Below are additional specifications:

- You must call the provided functions `DrawDisk`, `DrawStar`, or `DrawRect` to draw the face of the clock, including the hour and minute marks.

- Use the `plot` function to draw the hands. For example, `plot([x1 x2],[y1 y2],'r-','Linewidth',8)` draws a red line of "width 8" from (x1,y1) to (x2,y2). The hour hand in the figure above has a width of 8.

- The hour marks must be different from the minute marks.

- The hour marks for 3, 6, 9, and 12 o'clock must be different from the other hour marks.

- The hour hand must be easily distinguishable from the minute hand.

Choose colors and shapes as you wish. Here's a hint: hours, minutes, and seconds can be converted readily to an angle, so think in polar coordinates. A polar coordinate has two components: radial and angle. The radial component is like the radius of a circle; the angle is measured counter-clockwise from $0°$, which is the positive x-axis in the Cartesian system. In order to use MATLAB's plot function, you need to convert from polar coordinates (r, θ) to Cartesian coordinates (x, y):

$$x = r \cos(\theta) \quad y = r \sin(\theta)$$

where r is the radius.

Submit your file `clockFace.m` on CMS.

3   Pythagoras rules (!)

A Pythagorean triple is a set of three positive numbers, a, b, and c such that

$$a^2 + b^2 = c^2$$

Write a script `triples` to display and count all the *integer* Pythagorean triples with $a \le M$ and $b \le M$ where M is a user-input positive value greater than or equal to 4. Your script should keep prompting the user for M until a value greater than or equal to 4 is entered; it does not matter whether M is an integer or has fractional parts. We consider $a = 3$, $b = 4$, $c = 5$ and $a = 4$, $b = 3$, $c = 5$ to be two different triples.

Hint: Check all possible combinations of a and b. You may find the functions `sqrt` and `floor` useful. Below is our example output for $M = 15$. Your output should be in a similar format.

```
     a      b      c
   ---------------------
     3      4      5
     4      3      5
     5     12     13
     6      8     10
     8      6     10
     8     15     17
     9     12     15
    12      5     13
    12      9     15
    15      8     17
   There are 10 Pythagorean triples
   with a and b less than or equal to 15.
```

Submit your script `triples.m` on CMS.