CS/INFO 1305 Programming Exercise 1
Due Monday, July 20, at 2pm

1 The Earth, an oblate spheroid (a *what*?)

→ a sphere flattened at the poles

The surface area of an oblate spheroid such as the Earth is given by $A = 4\pi r_1 r_2$ where r_1 is the equatorial radius and r_2 is the polar radius. Write a program that calculates and displays the difference between $4\pi r_1 r_2$ and $4\pi((r_1 + r_2)/2)^2$ for Earth data $r_1 = 3963$, $r_2 = 3957$. Call the program `oblateArea`.

2 Function evaluation

Write three different programs (scripts) to determine in which quadrant a user-input value of A degrees belong. Assume that the user may enter any non-negative number. For example, 725° is the same, and should be treated, as 5°. (Hint: the function `rem` might be useful.) To avoid ambiguity, we use the following convention:

$$\text{Quadrant is } \begin{cases} 1 & \text{if } \ 0 \le A < 90 \\ 2 & \text{if } \ 90 \le A < 180 \\ 3 & \text{if } \ 180 \le A < 270 \\ 4 & \text{if } \ 270 \le A < 360 \end{cases}$$

Print the result. In the first script use four *separate* `if` statements (4 separate `if-end` constructs) and call the program `angle1.m`. In the second script, use a *single* `if-elseif-else-end` construction for the evaluation and call it `angle2.m`. In the third script, use *nesting* without using the `elseif` clause and call it `angle3.m`. Pay close attention to the differences among the three programs.

3 Golden rectangles

The *golden ratio* $\phi = (1 + \sqrt{5})/2$ is one of the most interesting numbers in all of mathematics. For example, the ancient Greeks regarded an L-by-W rectangle with $L/W = \phi$ or $W/L = \phi$ as the most aesthetically appealing rectangle.

Write a script `goldenRect` that randomly generates the length and width of a rectangle. The length and width should be in the range of 1 to 9. If the ratio of the sides (L/W or W/L) is within $\phi \pm 0.2$, draw the rectangle in red. If the ratio is really "unappealing," i.e., greater than 3, do not draw the rectangle. Otherwise draw the rectangle in yellow. Use the given function `DrawRect` (see Lab 1). Use the following statements to set up your figure window before drawing the rectangle (similar to `drawDemo` in Lab 1):

```
close all       % close all previous figure windows
figure          % open a figure window
axis equal off  % use equal scaling in the x- and y-axes; hide the axes
```

How to generate a random value? The statement `v= rand(1)` assigns to variable `v` a random number in the range of 0 to 1. Note that the 1 in the parentheses indicates that one number is to be generated—it has nothing to do with the range, which is always 0 to 1. So how do you get a random number within a different range? First, the statement `v= rand(1)` gets you a real number in the range of 0 to 1. Next, scale (think multiply) and shift (think add) the value `v` to get the range you want.

4 Stars, disks and rectangles

Write a script `myPoster` that uses the given functions `DrawRect`, `DrawDisk`, and `DrawStar`, to create a figure of your choice! The only requirement is that the script must involve the (meaningful) use of a `for`-loop. It is not necessary to use all three draw functions but you should use at least one. Have fun!