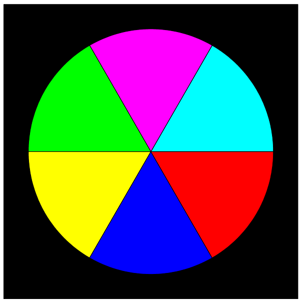
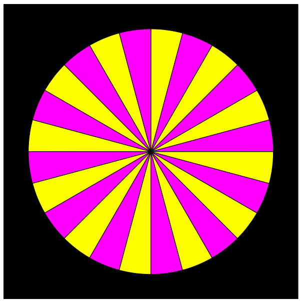
CS1115 Lab 5 (September 20, 2012)

Completing the lab is very important, but your work is not graded and it is not submitted. If you finish before the hour is over, then you can leave early or you can work on the "Finished Early" problem. If you do not finish the problems before the end of class, then be sure to ask enough questions so that you can complete the exercises in the next day or two on your own.

1 Pizza

From the Syllabus page, download the script `Pizza` and the the function `Slice`. (a)) Run `Pizza` and then write a good specification for `Slice`. (b) Modify `Pizza` so that it draws the six-slice pizza below. Hint: `tau = linspace(0,2*pi,7)`. "Six" is a small enough number that you can draw each slice "by hand" instead of writing a loop. (c) Modify `Pizza` again so that it draws the 24-slice pizza below. Now you will have to write a "one-to-24" loop that handles slice drawing.





2 UpDown Plot

Recall that the UpDown sequence always converges to 1:

```
n = Some positive integer
while n>1
   if rem(n,2)==0
     n = n/2;
   else
     n = 3*n+1;
   end
end
```

Implement the following function:

```
  function m = UpDownLength(n)
% n is a positive integer
% m is the number of steps required for the UpDown sequence to reach one starting from n.
```

Thus, since

$$13 \to 40 \to 20 \to 10 \to 5 \to 16 \to 8 \to 4 \to 2 \to 1$$

we see that `UpDownLength(13)` is 9. Now that you have implemented this function, write a script that plots the the points

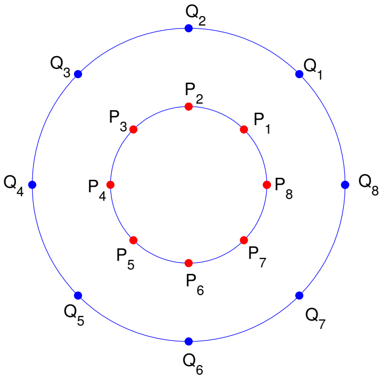
$$\texttt{(k,UpDown(k))} \qquad k = 1, 2, \ldots, 100$$

3 nStars

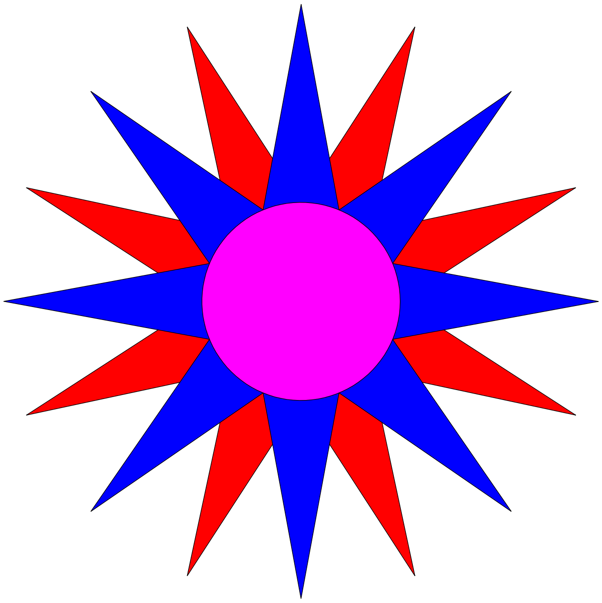
Define the points $P_1, \ldots, P_n$ and $Q_1, \ldots, Q_n$ by

$$P_k \quad = \quad (r_1 \cos(k\theta), r_1 \sin(k\theta)) \qquad k = 1 : nQ_k = (r_2 \cos(k\theta), r_2 \sin(k\theta)) \qquad k = 1 : n$$

where $0 < r_1 < r_2$, n is a even integer with $n \geq 4$, and $\theta = 2\pi/n$. Here is the picture for $n = 8$:



For $k = 1 : n$, define the k-th petal to be the triangle formed by Q_k and P_k's left and right neighbor. E.g., triangles $Q_1P_2P_8$, $Q_2P_3P_1$, etc. To draw a colored "n-star," you (1) draw all the odd-indexed petals with some chosen color, (2) draw all the even-index petals with some chosen color, and (3) draw the disk of radius r_1 with some chosen color. Complete the function `DrawNstar(r1,r2,n,oddPetalColor,evenPetalColor,diskColor)` that adds an n-star to the current figure window centered at (0,0). It is assumed that the `hold` toggle is on. The inner and outer radii are specified by `r1` and `r2`. The number of petals `n` should be even. The input parameters that specify the colors should be one `'k'`, `'w'`, `'b'`, `'m'`, `'c'`, `'r'`, `'g'`, or `'y'`. The script `ShowNstar` can be used to test your implementation. Here is what it should produce:



4 Finished Early?

You can superimpose nStars by calling `DrawNstar` 2 or more times leaving the `hold` toggle on. Modify `ShowNstar` to illustrate this. Produce a cool design through experimentation.

Please delete your files from the computer before you leave the lab!