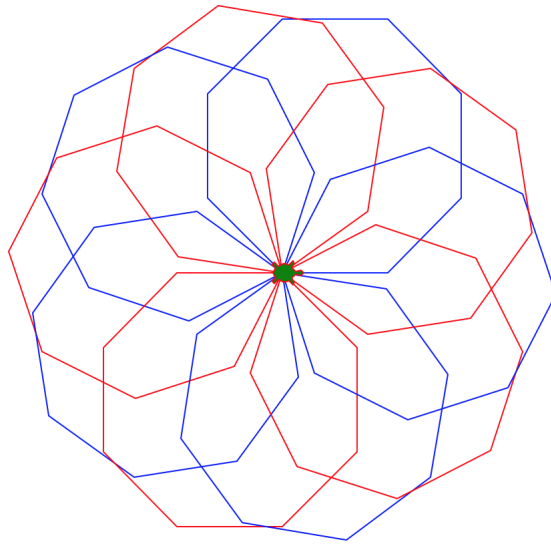


COMPUTER MODELLING FOR SCIENTISTS CSCI 2202
ASSIGNMENT 1, DUE 12 FEB 2021 11:30 PM

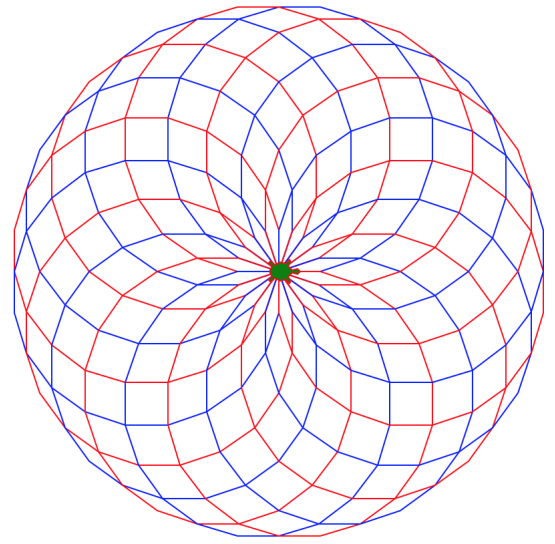
Note: Please put all your programs (titled `ex.n n = # of exercise`) into a single folder titled: `A1_your_name`, zip it and submit it through Brightspace. You may discuss the problems with anyone, but please do not copy/share/show code from/to each other. Acknowledge any help received (except that from the instructor and TA for the course).

- (1) In Lab 2, you made a program, using the turtle module, that could draw polygons of a user-specified number of sides. Create a new program that draws the polygon, rotated a specified number of times (you may use your program from lab 2 in this exercise).

Enter num sides : 8
Enter num polygons: 10

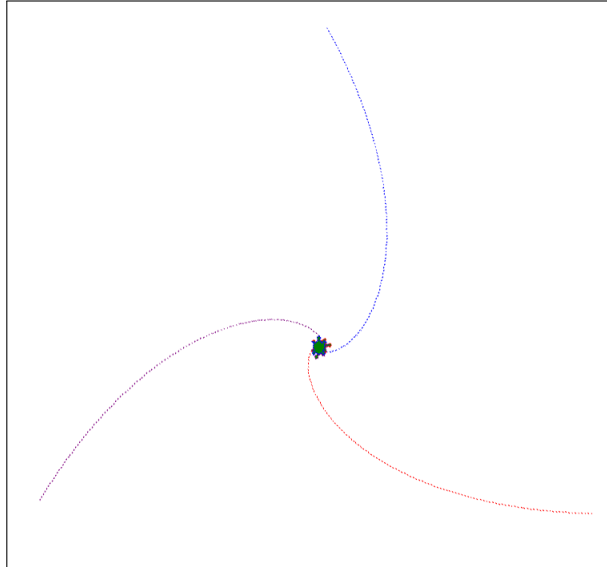


Enter num sides of polygon: 20
Enter num polygons: 20



Note the alternation of colours in the drawing (you may choose any colours, just that the alternation of colours should be kept). Make sure your figure stays within the window for any number of sides and and number of polygons.

- (2) Create a program `trianglePursuit.py`. For this, set up three turtles at the *corners of an equilateral triangle, of side 400 units*. In this program, turtle 1 chases turtle 2 . Turtle 2 chases turtle 3 and turtle 3 chases turtle 1. Each turtle should trace its path (use a different color for each turtle's path) as above. Stop the program when the turtles meet. You may need to specify a distance (rather than an exact location) to stop the turtles, as having multiple turtles stop in the exact location using floating point numbers is rare.



(3) In the book *Liber Abaci*, Leonardo of Pisa (better known as *Fibonacci*) considers pairs of breeding rabbits in an enclosure.

- At the start of month zero there is a single infant pair of rabbits.
- A pair of rabbits matures in 2 months.
- Rabbits do not breed in their first month of life.
- Each mature pair of rabbits produces an infant pair of rabbits on the last day of each month, starting with the second month.
- Rabbits are not mortal.

Leonardo asks: How many pairs will there be one year after this pair begins breeding. For more information about Fibonacci's problem see:

<https://tinyurl.com/y5sadcpb>

Let $F[j]$ denote the number of pairs in month j . A slight modification of the above problem gives:

$$F[0] = 0, F[1] = 1, \text{ and } F[j] = F[j-1] + F[j-2], \quad n \geq 2$$

- (a) Write program `FibonacciSeq.py` that prompts the user for a positive integer n and then computes and prints out the Fibonacci sequence up to $F[n]$. Your program should print the sequence with 5 Fibonacci numbers per line (except in the last line). The Fibonacci numbers for the range above are at most 4 digits. Use `print('{:5d}'.format(F[j]), end="")` to print values with widths of 5 digits. This will give a reasonable display (we will examine formatted output in the next lab). What is the answer to Leonardo's question?

You will need to refer to:

<https://docs.python.org/3/tutorial/datastructures.html> for list methods.

- (b) Make your program print compute the ratio: $\frac{F[j+1]}{F[j]}$ for $2 \leq j \leq 20$.

The limiting value of $\frac{F[j+1]}{F[j]}$ is known as the *Golden Ratio*. It appears in unexpected places

(see <https://www.mathsisfun.com/numbers/golden-ratio.html> scroll down to "Fibonacci Sequence").

- (c) Sketch the *Fibonacci Spiral*. The Fibonacci spiral is made up of quarter circles (i.e. arc of a circle subtended by a 90° angle) passing through the diagonally opposite vertices of squares that have sides in the Fibonacci sequence. Use the functions you wrote in Lab 5 to draw the arc. The figure on the left, with the squares, is to illustrate the drawing. The figure on the right is what your curve should look like (the first arc is drawn with the turtle facing East). To illustrate, each quarter circle arc is a different colour. The side lengths are scaled by a factor of 5 (i.e. a square of side length ℓ will be $5 \cdot \ell$ in the drawing). Your function `goldenSpiral.py`, takes a `turtle` as a parameter and have a default parameter `n = 10` for the number of arcs that make up your spiral.

Ex. of Spiral with squares drawn in

Golden Spiral with $n=10$ & scale = 5

