

# Computer Science I

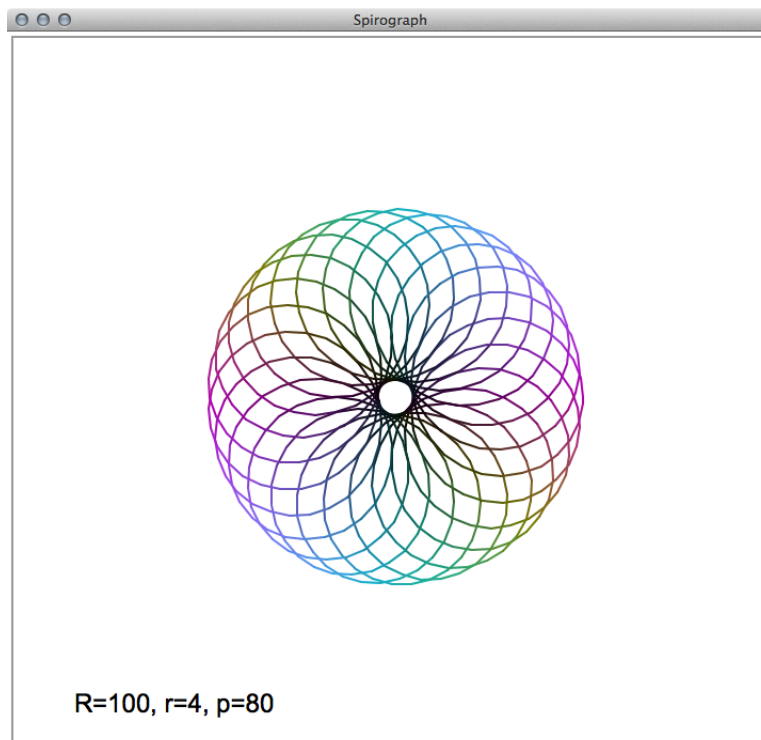
## Spirograph

# CSCI-141

## Homework

### 1 Problem

You will use the turtle drawing library to simulate images generated by the geometric drawing toy, Spirograph.



This image above is created by rolling a smaller circle inside a larger, fixed circle that sits on a piece of paper. A pen is placed in a hole in the rolling circle which moves around to draw the curve.

The equation for the resulting curve is determined by the following formula:

$$x = (R-r) \cos(t) - (r+p) \cos((R-r)/r * t)$$
$$y = (R-r) \sin(t) - (r+p) \sin((R-r)/r * t)$$

There are three constants in the formula whose values are indicated in the drawing:

- R = The radius of the fixed circle
- r = The radius of the moving circle
- p = The offset of the pen point in the moving circle

The curve is drawn by iterating  $t$  between  $2\pi$  and 0, in intervals of  $-0.01$ . For each new value of  $t$ , you must compute the new  $(x, y)$  coordinates using the formulas above, and then move the turtle to those coordinates.

## 1.1 Requirements

- The name of your program must be `spirograph.py`
- When run, the program should prompt the user for an integer value for `p`:  
`p (10-100):`
- If `p` is not within the range of 10 to 100, inclusive, your program should print the following message to standard output and exit:  
`Incorrect value for p!`
- If `p` is valid, it should be used in the formulas and draw the curve.
- When the program is finished drawing, you should pause the program with the message:  
`Hit enter to close...`
- Your program does not have to generate the image in color.
- Your program does not need to write the label on the screen in the lower left that indicates the constant values.
- Use either recursion or a while loop to generate the image.

## 1.2 Notes

To draw the curve you need to constantly move the pen to the computed coordinates using the `turtle.goto(x,y)` method.

For example, to begin drawing the curve you will want to lift the pen up, move to the computed coordinate for `x(0)` and `y(0)`, and then put the pen down. Next you will loop the `t` value as mentioned on the first page, each time computing the new coordinates for `(x,y)` and moving the turtle to them.

It may be necessary to connect the curve in the end by doing one last move to the computed `x(0)` and `y(0)` coordinate.

The constant `pi`, as well as the `cos` and `sin` functions, come from the `math` module.

If you want to experiment with color in your drawing, look up the documentation for the `turtle.pencolor()` method.

## 1.3 Submission and Grading

- 75%: Recursive or iterative implementation producing the expected picture.
- 5%: Program prompts for constant integer `p`.
- 10%: Program prints an error message and exits if `p` is out of range
- 5%: Program prompts user for input after drawing the picture but before exiting.
- 5%: Correct style, with docstrings for each function.

Put your program code with the appropriate docstring documentation into a file called `spirograph.py` and submit that file to the MyCourses dropbox for this assignment.