Metropolitan State University, Saint Paul, Minnesota

ICS 140 Computational Thinking with Programming

Lab 8

**Goal**: To learn to code for loops in conjunction with selection statements in the context of solving a problem.

In this lab, you will write Python code using conditionals and for loops.

This program draws a set of squares one inside the other. The x and y coordinates of the top-left corner of the outermost square, the side of the largest square, and the gap between successive squares are input to the program in pixels. The program draws the squares only if the side of the largest square is at least 100 and the gap is less than the side of the largest square.

The program must read in the x and y coordinates of the top-left corner of the largest square first. It must then read the side of the largest square. The gap between two squares must be read in only if the side of the largest square is at least 100. The squares are drawn only if the gap is less than the side read in.

|  |
| --- |
| Enter x coordinate of top-left corner: -200  Enter y coordinate of top-left corner: 300  Enter side of the largest square: 200  Enter gap between squares: 30    The top-left corner and length of side are different for the squares  -200, 300 |
|  |

Observe the following additional requirements.

1. All squares have their bottom-right corner at the same vertex. It is the top-left corner that gets shifted for successive squares.
2. See the above interaction for the kind of prompts, behaviors, and displays. Your implementation must be identical to the prompts, order, and nature of the display of the squares.
3. The number of squares must be as large as possible. That is, the smallest square must have a side such that drawing one more square (with a positive value, of course, for side) is impossible.

Here are the major steps of the program. The steps vary in detail: from actual Python code to high level suggestions.

x = int(input("Enter x coordinate of top-left corner: "))

y = int(input("Enter y coordinate of top-left corner: "))

side = int(input("Enter side of the largest square: "))

if side is at least 100

gap = int(input("Enter gap between squares: "))

if gap < side:

determine the number\_of\_squares

draw the right and bottom edges of the largest square

loop for each square

move the turtle to the top right corner of the square

draw the top and left edges of the square

compute the side and the x and y coordinates of the top left vertex of the next square

To help you construct the details of the program, answer the following questions. From these, you should be able to develop the Python statements for the steps in blue

1. (1 points) What is the number of squares to be drawn?

side gap Number of squares

30 7

40 8

Can you see how the number of squares is dependent on the values of side and gap?

Look at the function math.ceil given below. It should be very useful.

math.**ceil**(*x*)

Return the ceiling of *x*, the smallest integer greater than or equal to *x*. If *x* is not a float, delegates to x.\_\_ceil\_\_(), which should return an [Integral](https://docs.python.org/3/library/numbers.html#numbers.Integral) value.

You will need to import math, in case you decide to use the ceil function.

1. (0.5 points) draw the right and bottom edges of the largest square

What would be the steps for drawing these two lines?

1. (0.5 points) What is the loop header (for loop) for drawing the squares? (1 point)
2. (0.5 points) move the turtle to the top right corner of the square

Write the Python statement for this.

1. (0.5 points) draw the top and left edges of the square

Write the Python statements for this.

1. (1 point) compute the side and the x and y coordinates of the top left vertex of the next square

Suppose the outermost square has its top-left corner at x = -100 and y = 200. Let the side of the largest square be 150 and gap be 30.

What should be the values of side and the x and y coordinates of the second largest square?

side = **120**

x = -**130**

y =**170**

Based on how you arrived at the above three values, develop Python statements for computing the side and the x and y coordinates of the top left vertex of the next square?

After testing the program, upload it to the dropbox for Lab 8. You don’t need to put any documentation, but you must write your name at the top of the Python file as a Python comment.