

4.1 Graphics Galore pt. 1

Instructor Guide

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Overview

As students are entering the class, they will be asked questions as a review of the previous material. After, there will be a class discussion on the new topics including, for loops, while loops, graphics and random.

Next, the students will go through the **Graphics Galore Paper Programming** to gain a small sense of what graphics are on a computer and how to write them in code. Then, the students will go off and work with their partners or mentors on the two files found below.

This lab works as an introduction to both graphics and loops, pulling both together to learn a lot in a fun way!

Learning Goals

- Understanding the parameters for drawing a rectangle, and what they represent on the screen
 - `canvas.create_rectangle(x0, y0, x1, y1, fill="red")`
- Understand syntactically how to write a for loop
 - Using a colon and wording
- The variable assigned in the for loop will take on all of the values in its range non-inclusive of the last number
- A for loop will end after it iterates through all of the numbers in its range non-inclusive of the last number
- Understand syntactically how to write a while loop
 - Using a colon and wording
- Understand the conditional statement in which a while loop will occur
- Understand when a while loop starts and ends
- `random.randint(#1, #2)` will return a value between the first and last number inclusively

Personal Growth Goals

- Creativity: Students will have to manipulate code to affect drawings. Students will be able to learn on their own, and that involves creatively thinking of new ways to affect the code.

Skills Required

- Understanding of variables, conditionals, integers, functions with parameters, and function flow

Resources Required

- Computers for either every student or every pair of students
- Python 3 needs to be installed on all the computers
- One mentor per 2-3 students
- Graphics Galore Paper Programming
- A projector to project the central instructor's computer
- Pencils for each student

Instructor Preparation

1. Make sure all the computers students will use have Python and a text editor (right now, we use Pyzo) installed (check to see that students have a way to save/access files)
2. Load the following [programming files](#) onto each computer:
 - a. 04_fun_functional_art.py
 - b. 03_01_rectangles.py
3. Also, have one **Graphics Galore Paper Programming** printed out for each student.

In Depth Description of Lab Activities

Phase 1: Setup

1. Before the students arrive, open the following files in a text editor on each computer:
 - a. 04_fun_functional_art.py
 - b. 03_01_rectangles.py
2. Have one printed out **Graphics Galore Paper Programming** for each student on the desks, and pencils available if needed.

Phase 2: Introduction | Lecture

1. Review:

- a. Have a quick class discussion using the following questions?
 - i. How do you create a function?
 - ii. How do functions take in parameters?
 - iii. When would you put a function within another function?
 - iv. How would you put a function within another function?
2. New Material:
 - a. Using a computer projected to the class, a main teacher should teach the following topics:
 - i. Random:
 1. Random is a module that you can import into python to do a number of things.
 2. Currently, we will just use `random.randint(#1, #2)` to return random numbers.
 - ii. Drawing:
 1. Tkinter is Python's standard GUI (Graphical User Interface) package**, it is what we use to draw cool things!
 - iii. Loops:
 1. Has anyone ever heard of a loop before?
 2. Talk about what a for loop does, and what you have to send it.
 - a. For `i in range(#1, #2)`, `i` will be set equal to `#1`, then all the numbers up to but not including `#2`.
 - b. Non-inclusivity
 3. What do you think a While loop does?
 - a. A while will continue to iterate, until the condition it is given equal false.
 - b. The condition you can give while loop is similar to that you can give an if statement something testing equality.

Phase 3: Graphics Galore Paper Programming

1. As a class, make sure everyone understands the basic concept of the x-y axis.
2. Then have the students see what a computer screen could be represented as using Challenge 1 in Graphics Galore:
 - a. The cells of the grid are representative of the pixels on the screen or on your phone.
 - b. Each cell can be represented by an x-y coordinate as shown in some of the boxes.
 - c. Ask: What do you notice differently about the direction of the y-axis?
 - i. Answer: The y-axis is inverted, it increases as it goes down.
 - d. Have the students fill in some of the cells now with the correct coordinates.
 - e. If any student doesn't understand what is going on at this point, a teacher or mentor should really try to reinforce the idea that is trying to be expressed, a computer screen is just a big grid of tiny pixels.

3. Challenge 2:
 - a. Have the students try to complete Challenge 2 on their own.
 - b. After they complete this assignment and a mentor has checked it for correctness, explain how a drawing is created in our programming language.
 - c. Show the correlation between the points that they found, and how we create a rectangle in programming.
 - d. Represent the x_0 , y_0 , x_1 , y_1 as the general case, and show how we could have drawn the specific rectangle above.
4. Challenge 3:
 - a. On their own, or with a friend, have the students draw arrows to what each line drew in the grid.
 - b. If they are having trouble understanding what to do, have their mentors guide them through this challenge.

Phase 4: Fun Functional Art Activity

1. Students will complete this activity on their own, gaining help from their mentors or partners.
2. Remind the students that their syntax guides are a useful tool if they forget what a certain statement does!

Phase 5: Rectangles Activity

1. This is where the students are really able to explore and learn what is happening on their own. They will be changing code to see what numbers do what, and why they do them.
2. Similarly to before, students should work on their own or with their mentors to complete the challenges.
3. Challenges 1.3-1.5, though, are a lot harder to conceptually understand, and therefore, the students may require a lot of guidance for these questions.

Phase 6: Pack up | Review

1. Mentors should lead a discussion with their students based on the question: What do you think that you can do with these tools now?
2. This question may be useful to use this as a form of review, and can also be used to increase interest in the subject.

Lesson Plan

(:10) means that this part should be done by the tenth minute of the lesson

1. Setup (:0)
2. Introduction (:15)
3. Graphics Galore Paper Programming(:25)
4. Fun Functional Art Activity(:40)

5. Rectangles Activity(:55)
6. Pack up | Review (:End)

Take Away

After this class, students should understand the basic components of what and how to draw rectangles on the computer using Tkinter. They should also understand when a while loop and for loop start and ends, and the values a for loop's variable takes on.

