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Course: CS151
Section: A
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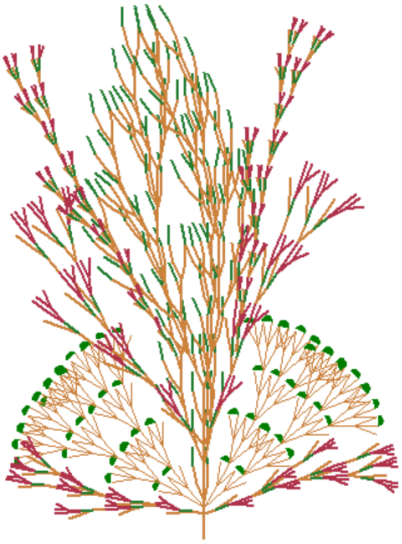
Project 9 Report: Better (L-system) Trees
Title: Making Natural Prints with L-systems
Abstract: Lecture concepts that made this project possible are any and all lectures and information in regards to L-system creation, implementation, and modulation. This project nearly entirely revolves around L-systems and various ways to bring them into design, but also relies on some turtle functions which we have used frequently. This project differs from the last in that we also used classes here. Classes and global variables showed new ways to not only inherit properties, but also have one variable work in different functions. I used this with a global draw function, which called all my L-systems within different functions. The outputs here are a flower arrangement in Image 1, made with a few different L-systems, and an attempted recreation of Image 3 in Image 2, which also uses many different L-systems.
Results:

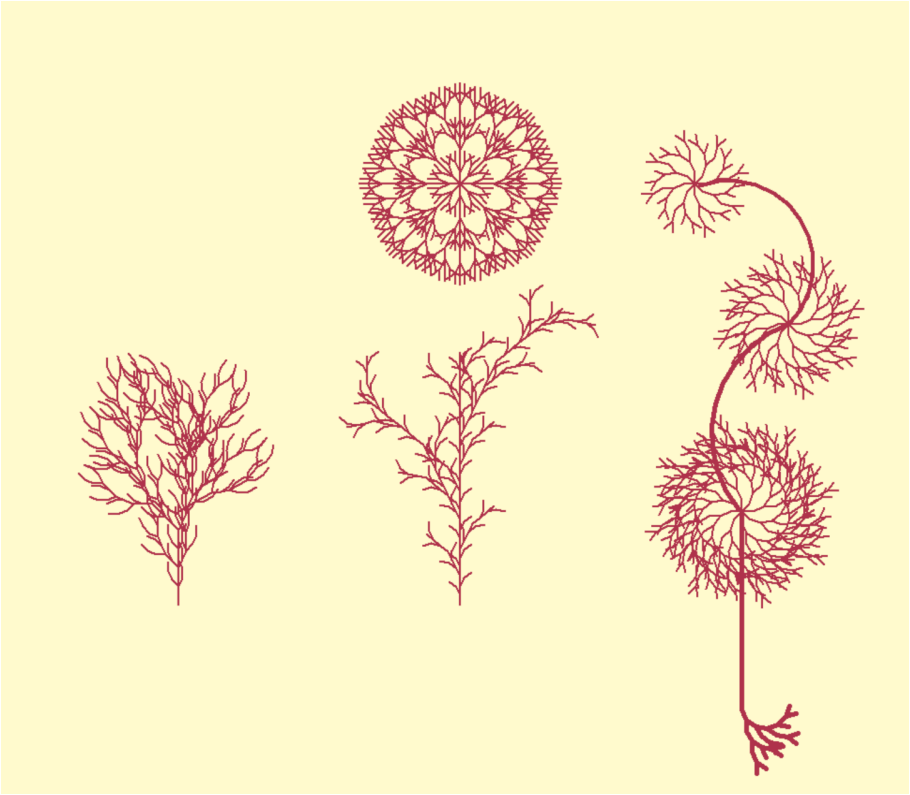
IMAGE 1:



This is my arrangement, which attempts to make a flower bouquet, although it did not come out as well as I had hoped. This bouquet is made up of 4 different L-systems: trees 1-4. Tree1 is the typical tree we used in last week's lab and project. Tree2 is a stubbier tree that splits off as it grows. Additionally, I also put leaves on this tree by adding code to the turtle interpreter to understand that 'l' means to draw a semi-circle and fill it green. Trees 3 and 4 are very similar, and Tree4 is just a variation of 3. This is supposed to be some sort of rose flower, which I used

red for. Then, I played with the angles, distances, and positions using the place function I made and came up with this arrangement. I also made another color code in the interpreter: ‘t’ for ‘tan’, which represents the stems of the flowers.

IMAGE 2:



This is my attempt at recreating one of the images by Haeckl. Although it didn’t come out quite right and I could not figure out how to represent the remaining shapes, I think the ones that are there are pretty cool. This is comprised of 4 separate L-systems, the files of which can be found in the zipped folder by the names growth1-4.txt. Growth1.txt is the straggly tree in the middle of the screen. This specific L-system I made by modifying L-system example A on page 25 of the ABOP book. I liked how branches extended out on both sides of the trunk and tried to use that as a base, although mine still didn’t come out quite right. Then I moved onto the circle at the top middle, which is made with growth2.txt. At first I started out with a simple “Y” shape and grew out the rule from there. Increasing the iterations also made this shape more complex. Then, to get a circle, I set the heading to 90 used a for loop to draw this L-system 8 times, changing the heading by 45 degrees on each iteration. Then I made the tree on the left. I tried to get the pines/leaves to look like they did in Haeckls work, but I could not solve this problem with the L-system. So, I settled for modifying one of our trees from the labs which is reflected in growth3.txt. Finally, the last shape is supposed to represent the flowering thing on the right side in the original image. For this L-system, I modified my growth2.txt rule, so growth4.txt is much simpler. I then made 3 versions of the system, with 2, 3, and 4 iterations (as seen with sizes), and put them in different places. Then I used the pythagorean theorem to figure out how to make arcs which are the stem connecting the flowers. For all of these images, I used the place

and setWidth functions from the turtle_interpreter to give me more control over size and location.

IMAGE 3:

This is Haeckl's original image which I attempted to recreate.

Reflection and followup questions:

Follow-up Questions

1. The self parameter in a class method is the instance of the class that the method is being called on. It allows the method to access and modify the attributes of the instance.
2. To call a method y on an object x, you can use: x.y()
3. I used Ernst Haeckel's print "Florideae," as seen above

Extensions:
If you do an extension for this project, include a **screenshot of the extension work** (deep extensions are better). Explain specific extensions, the extension description and process, and resulting extra extension image(s) that are included to demonstrate your work beyond the required images.

Sources, imported libraries, and collaborators are cited, **or a note is included indicating that none were referenced:** This ensures you are properly crediting the people and sources

who help you achieve your results. Not listing them in the report is considered plagiarism or stealing. Please code with honor.

- https://archive.org/details/ArtFormsOfNatureByErnstHaeckl/page/n86/mode/1up
- https://trinket.io/docs/colors
- http://algorithmicbotany.org/papers/lsfp.pdf
- CS151 A – Google Classroom: Lecture Slides on L-systems and Classes

- `lsystem.py`: Shows lsystems functions (version 2)
- `turtle_interpreter.py` draws your lsystems (version 2)
- `arrangement.py`
- `growth.py`
- Any other test files required to run your code--if you used command line arguments include instructions for graders

Include your required images in your report Google Doc and include your Lab 09 file in your zip file.