

CS21: INTRODUCTION TO COMPUTER SCIENCE

Prof. Mathieson

Fall 2018

Swarthmore College

Outline Dec 7:

- Merge sort (recursive sorting)
- Fractal trees (recursive graphics)

Notes

- Office hours today! **3-5pm**
- Last Ninja session tonight!

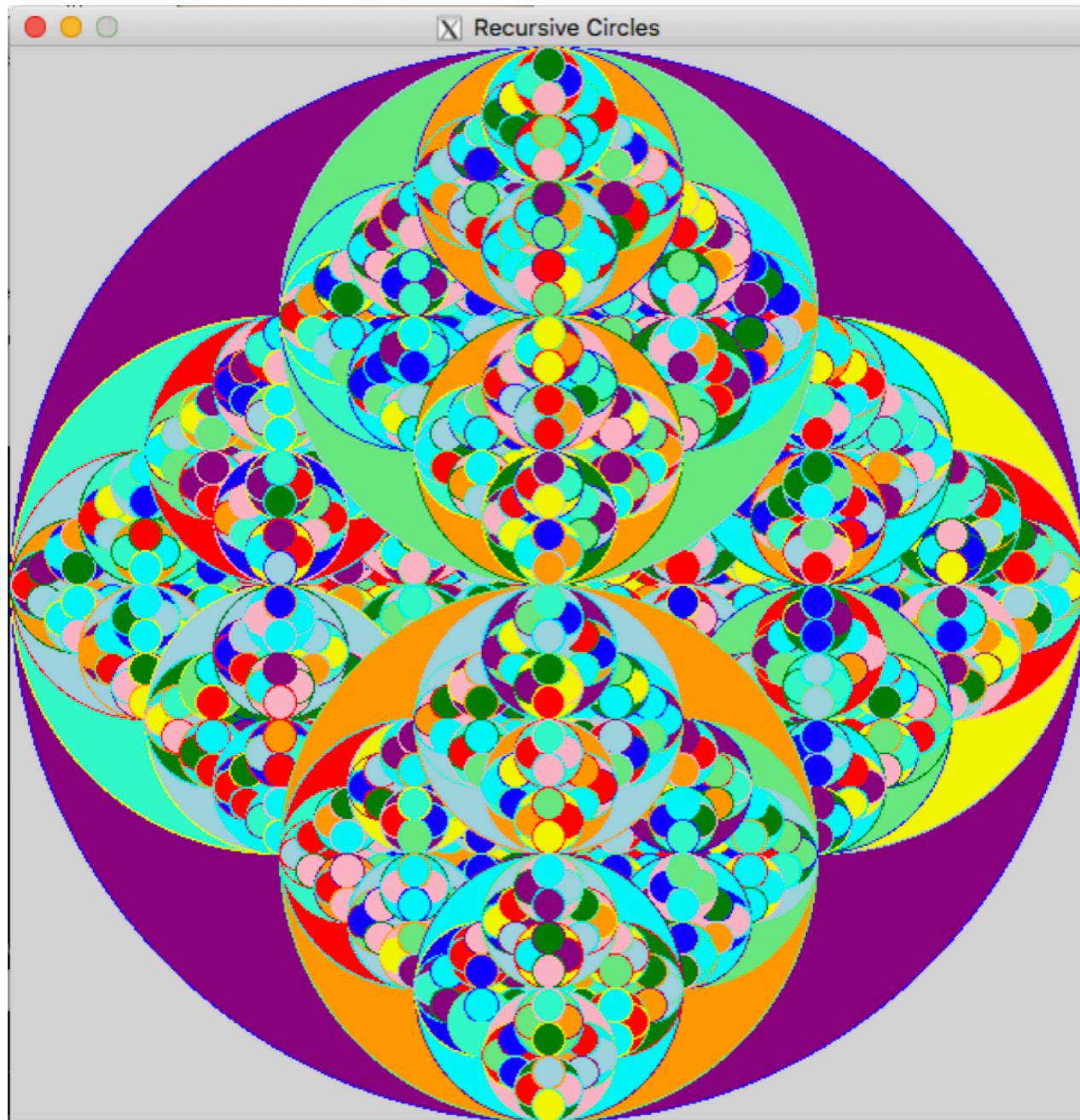
Final Exam

Studying for the final

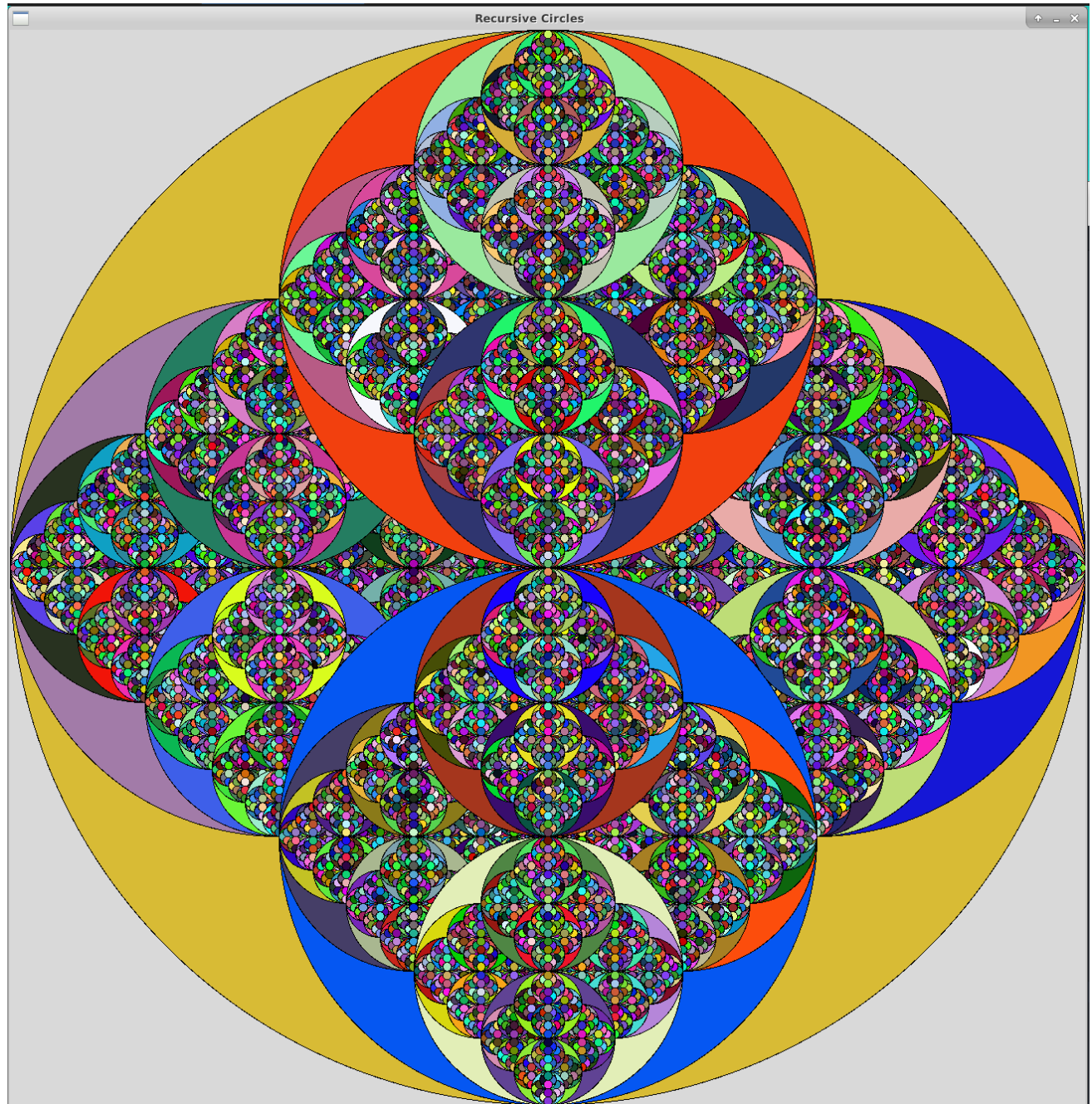
- Exam time: **Saturday Dec 15** (week from tomorrow), **2-5pm**, Science Center 101
- We will post **study guide for recent material** soon
- Go through all notes, code, and practice problems
- Write out as many problems as you can **on paper** (then check in atom)
- Go back over old quizzes and their study guides
- Create a **“cheat-sheet”** for yourself of important concepts and examples (even though you can't use it)
- Come to office hours on **(will post on Piazza)**

Recursive circle examples

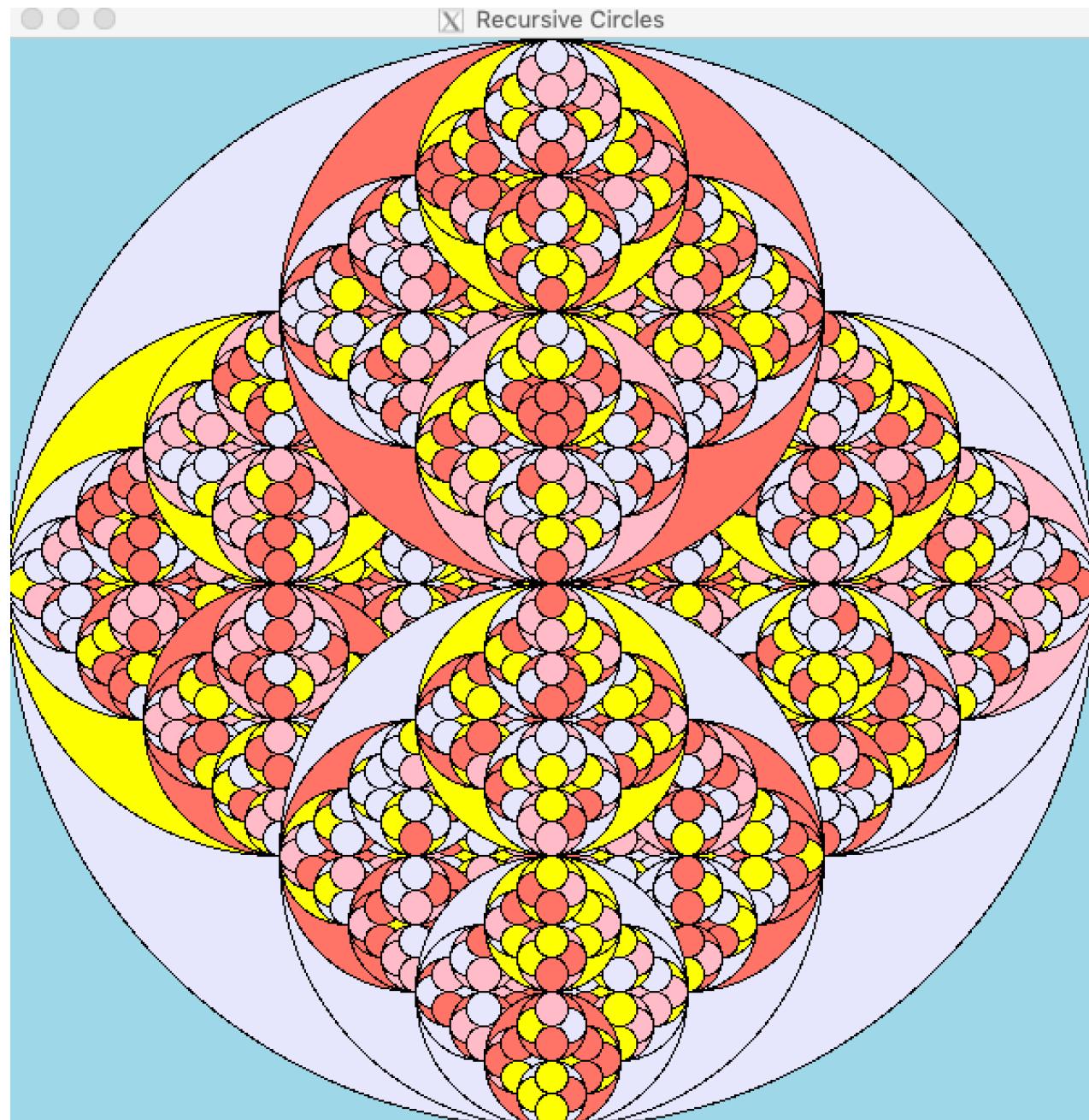
Ollie



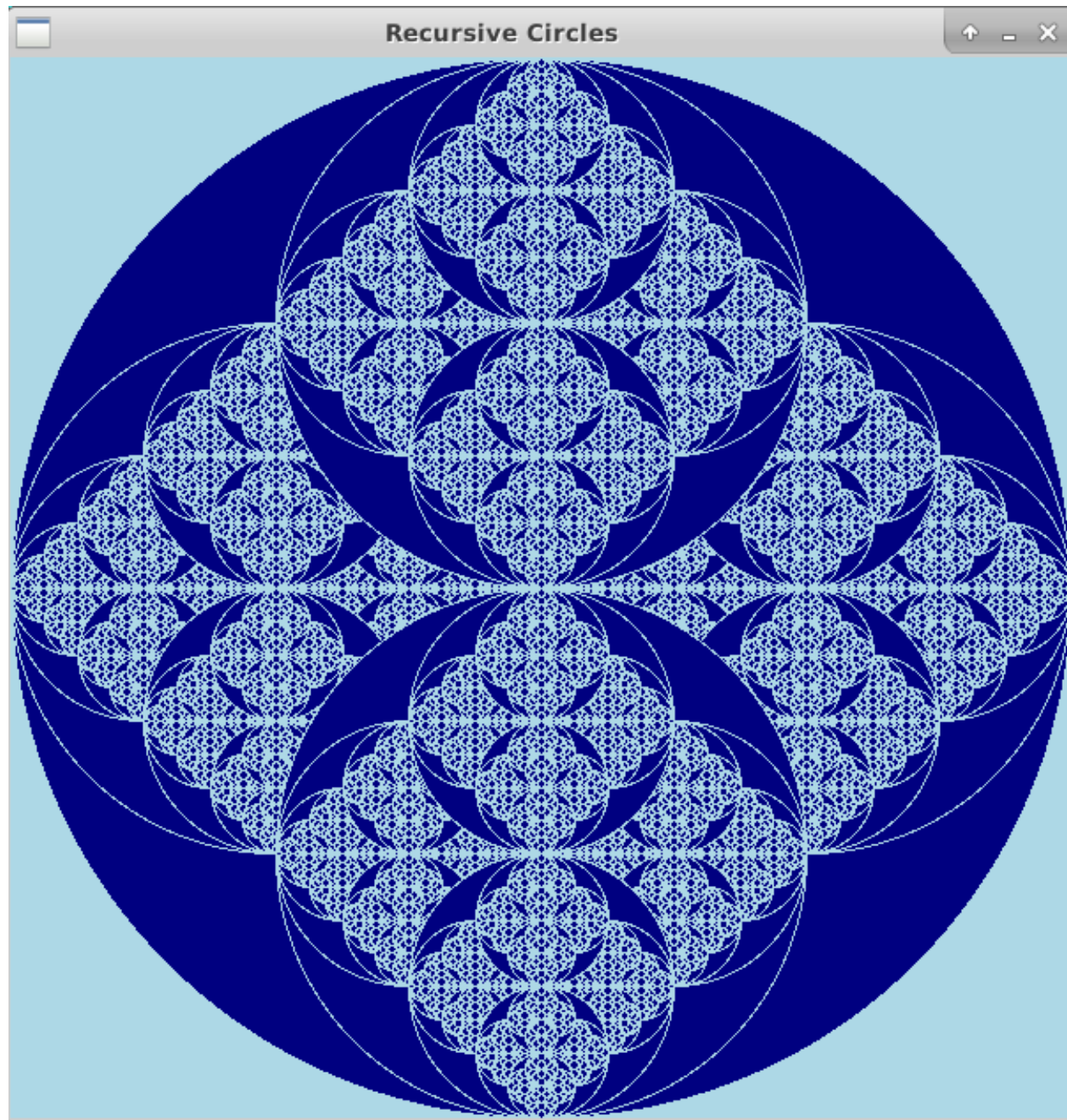
Charlie F.



Elizabeth



Karin



Jason

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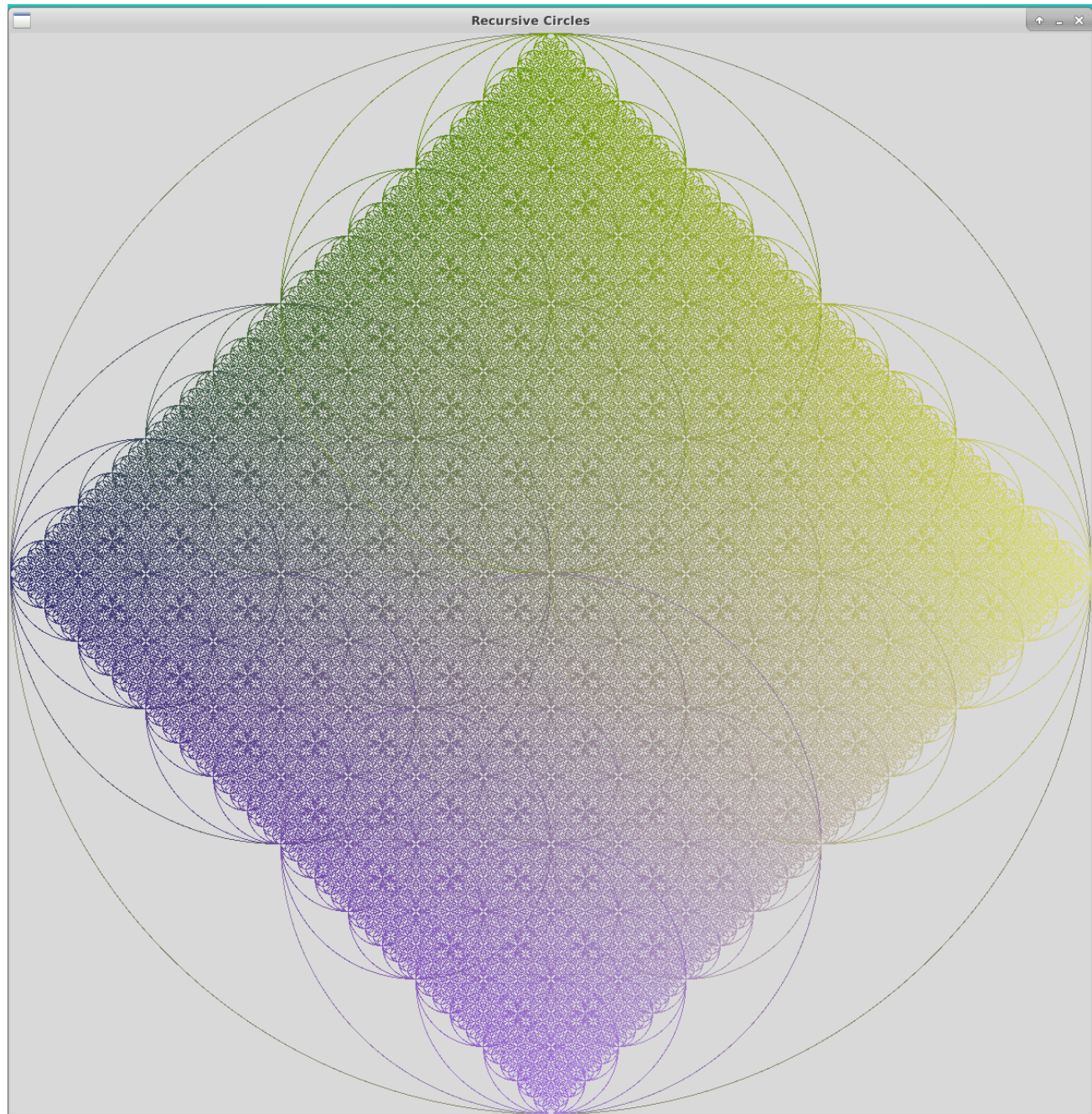
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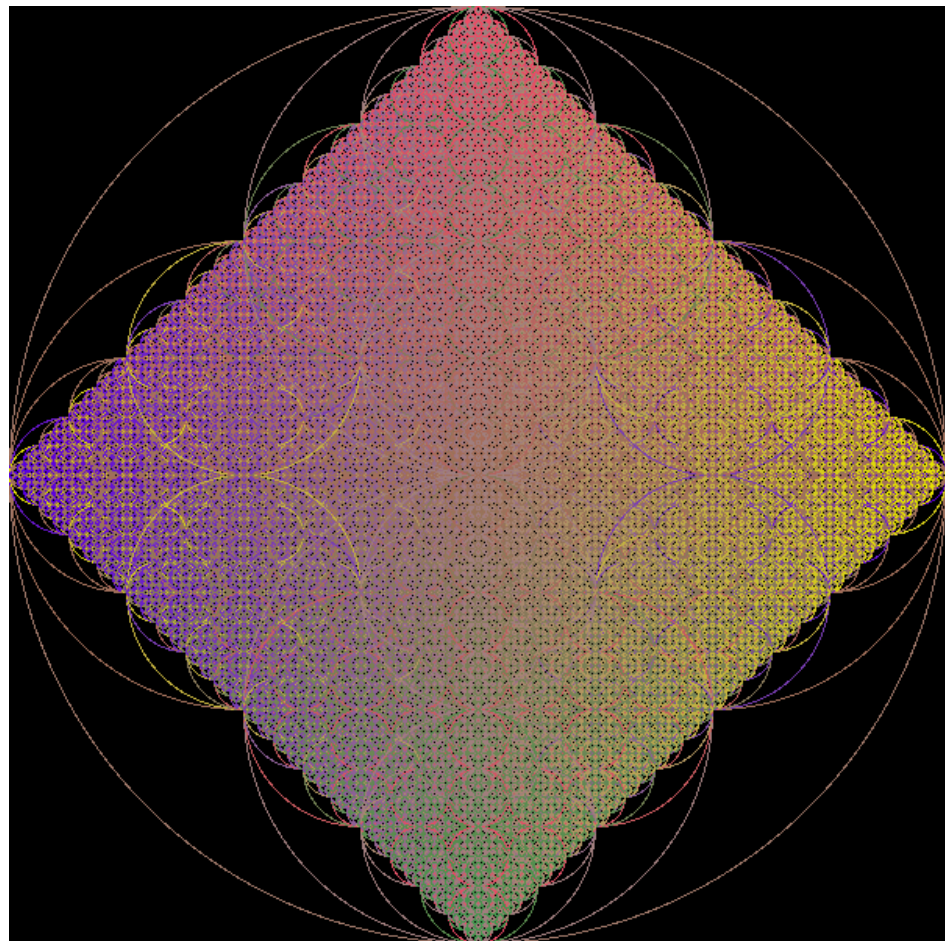
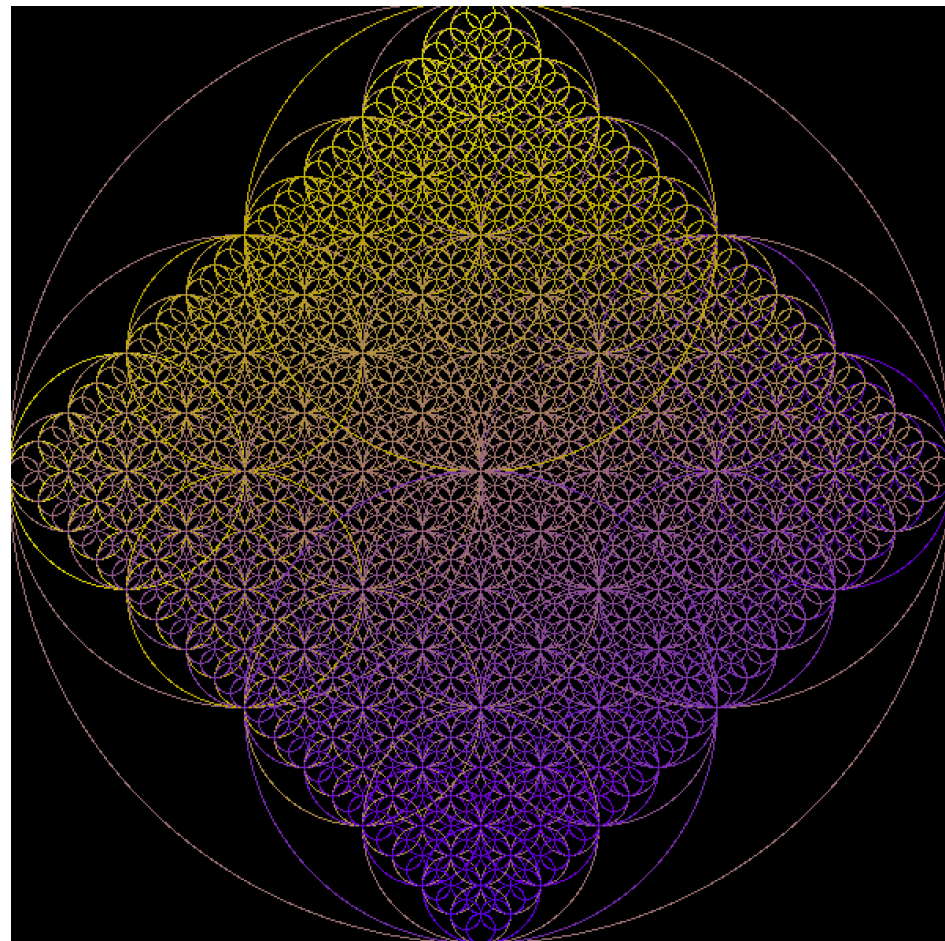
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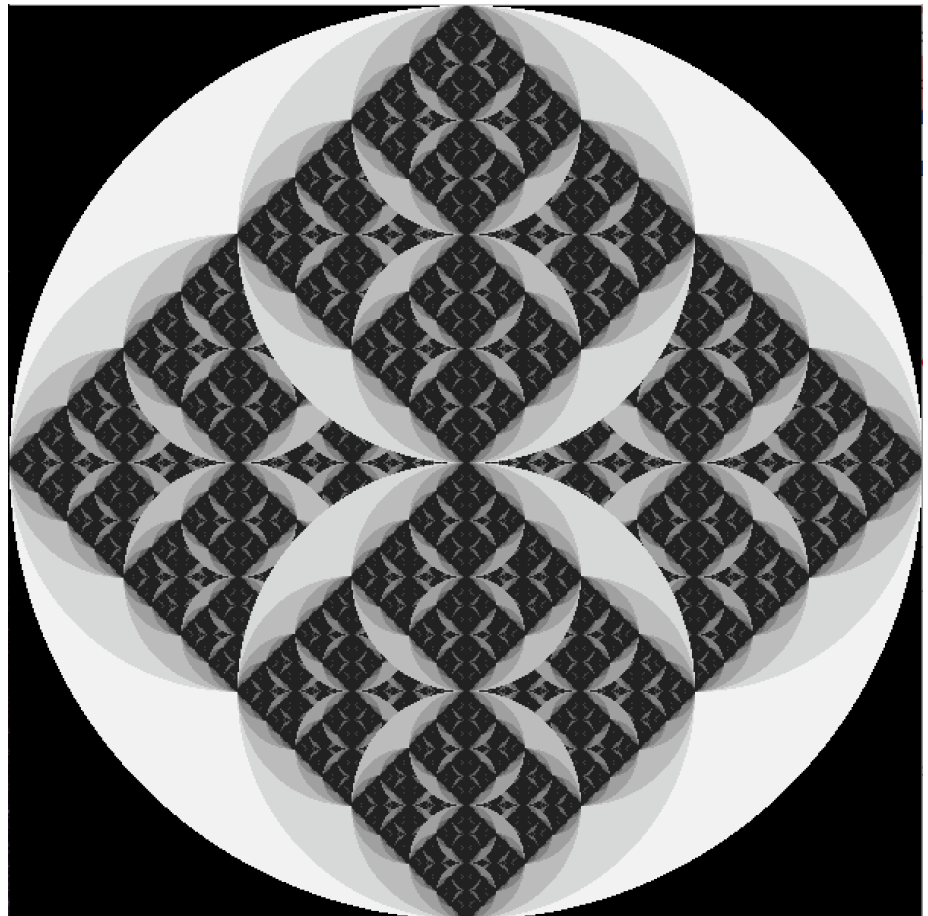
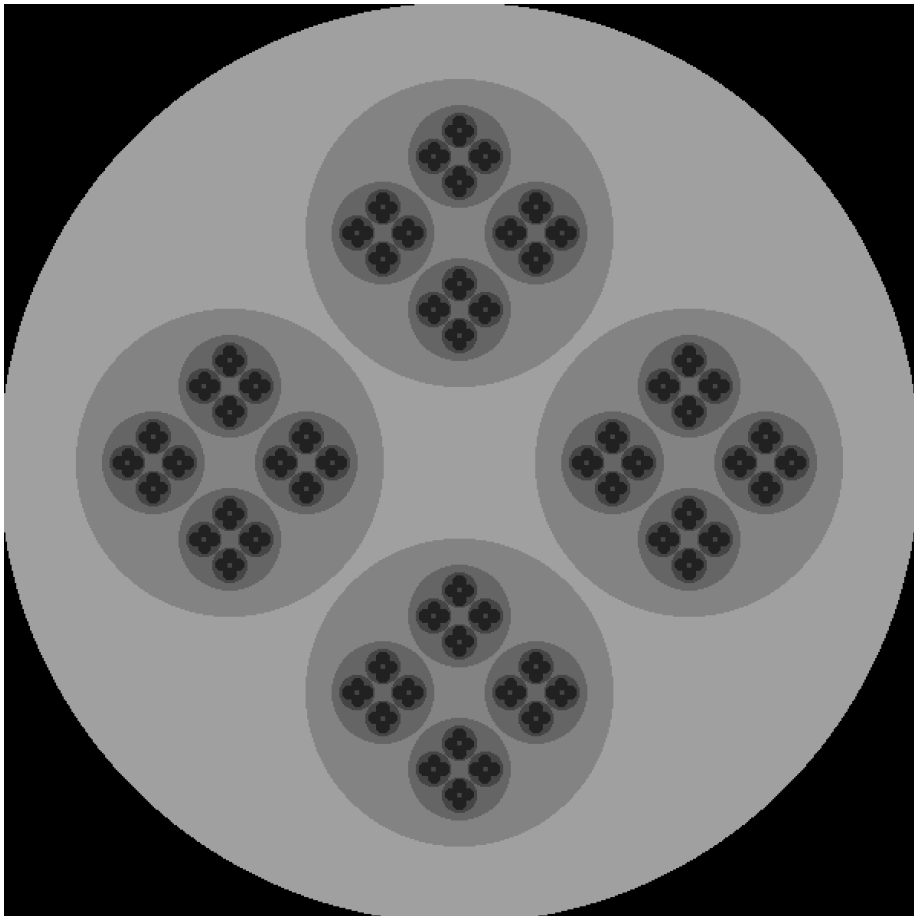
Otis



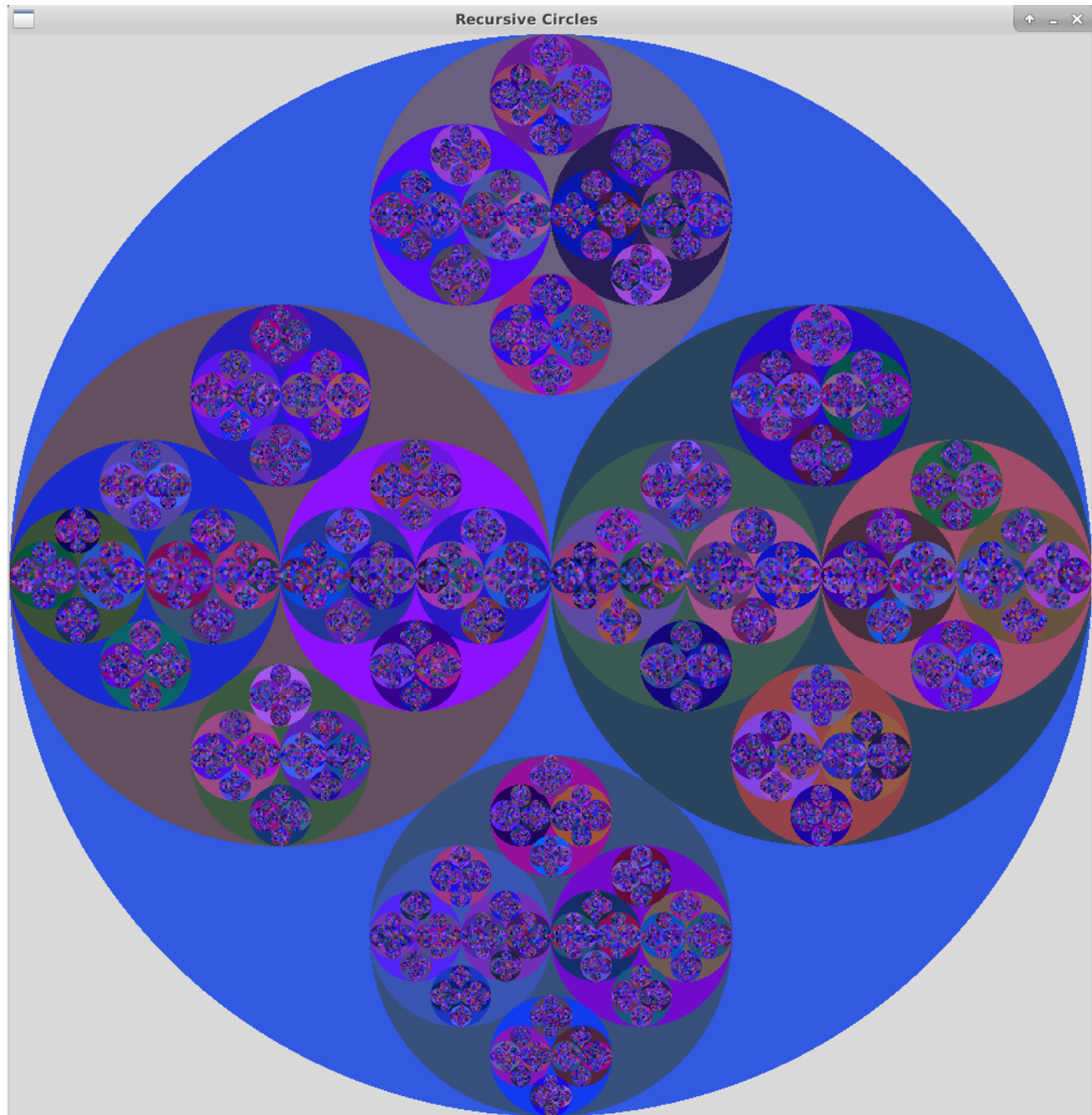
Ilana



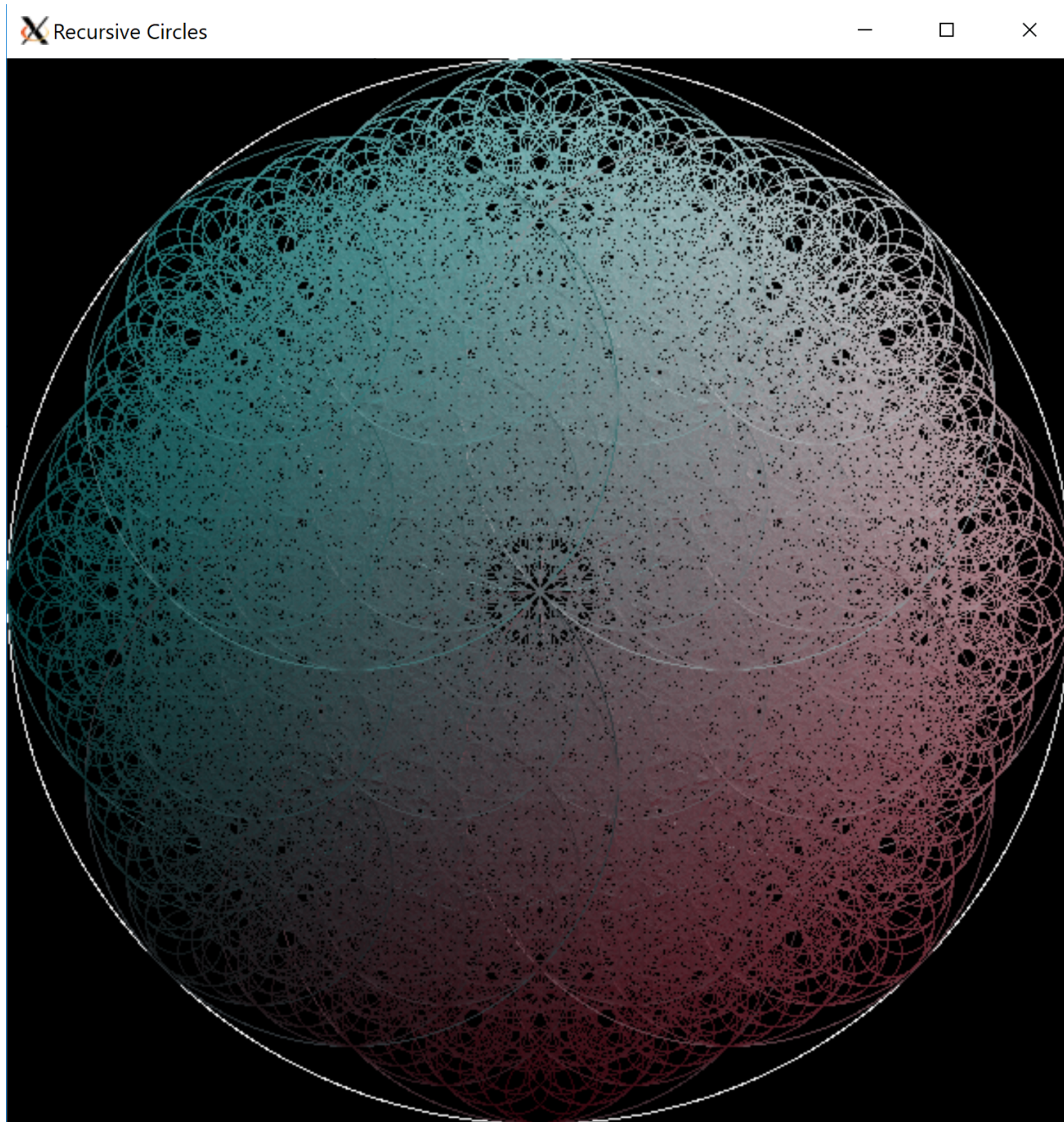
Kat



Sarah



Juan



Merge Sort

$n=8$

$$\frac{n}{2} = 4$$

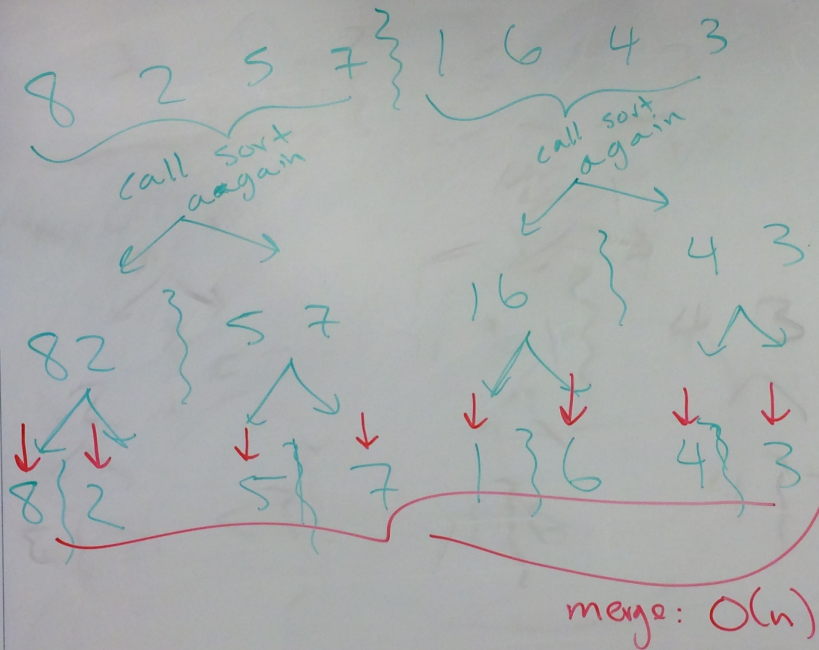
$$\frac{4}{2} = 2$$

$$\frac{2}{2} = 1$$

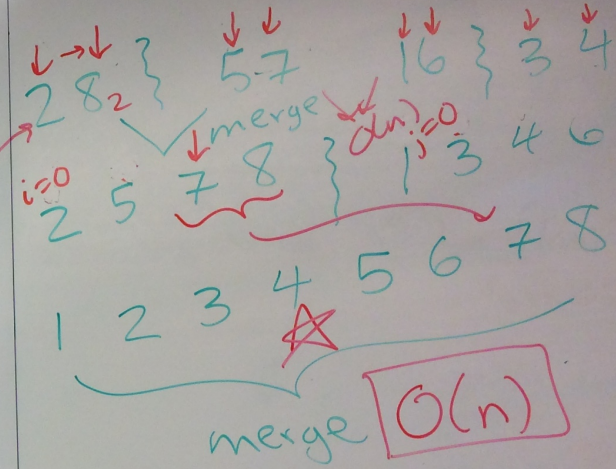
$$\dots$$

$$\frac{n}{2^x} = 1$$

$\Rightarrow x = \log(n)$



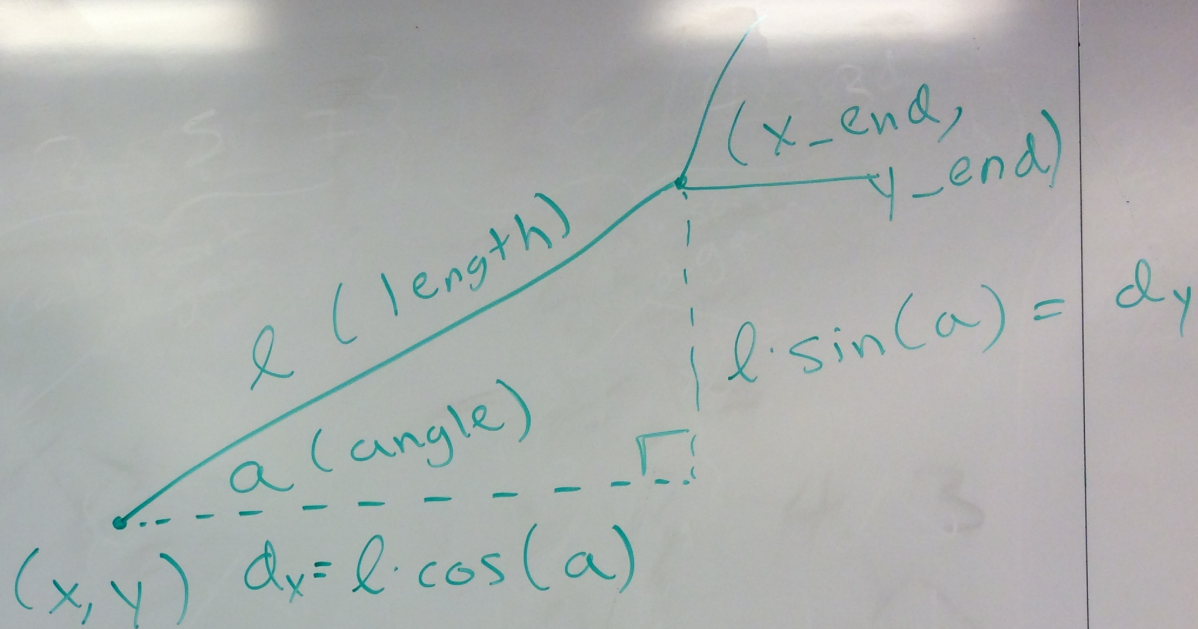
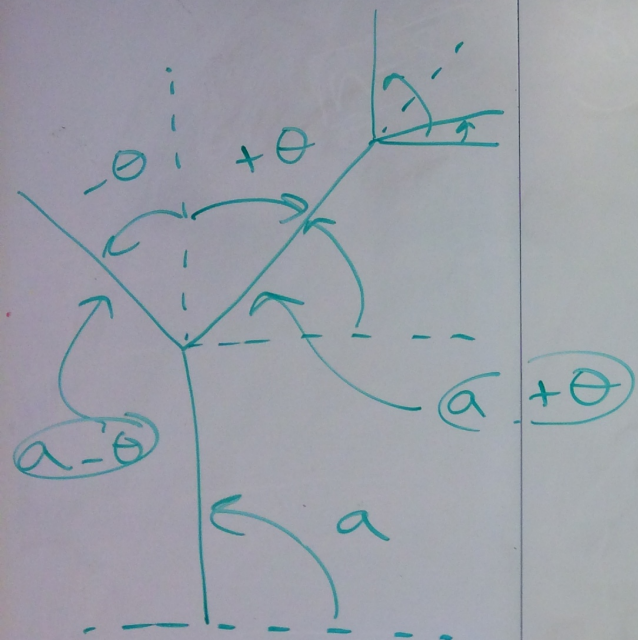
append: one element
extend: a list of elements



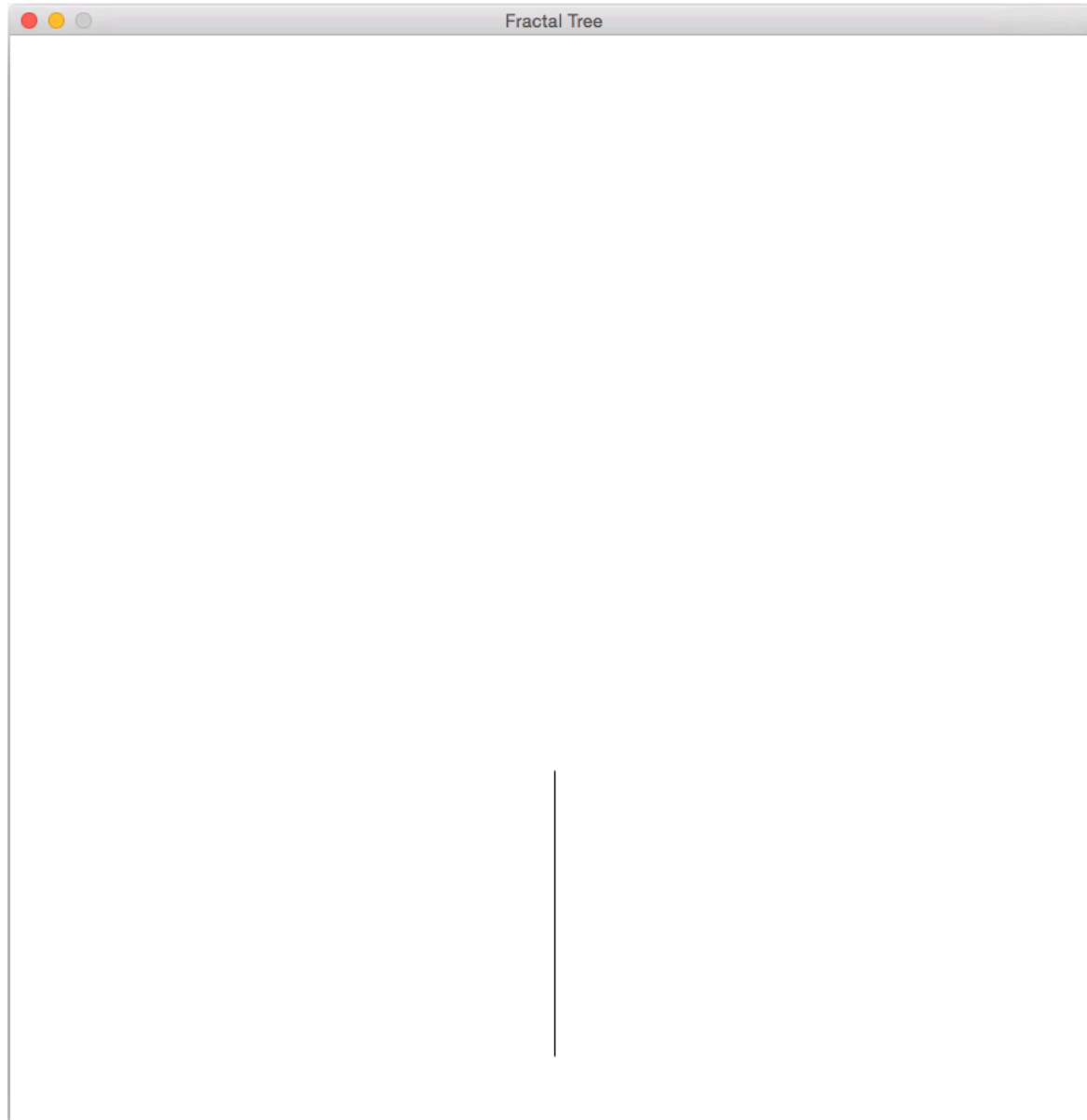
runtime = $O(n \cdot \log n)$

before: $O(n^2)$

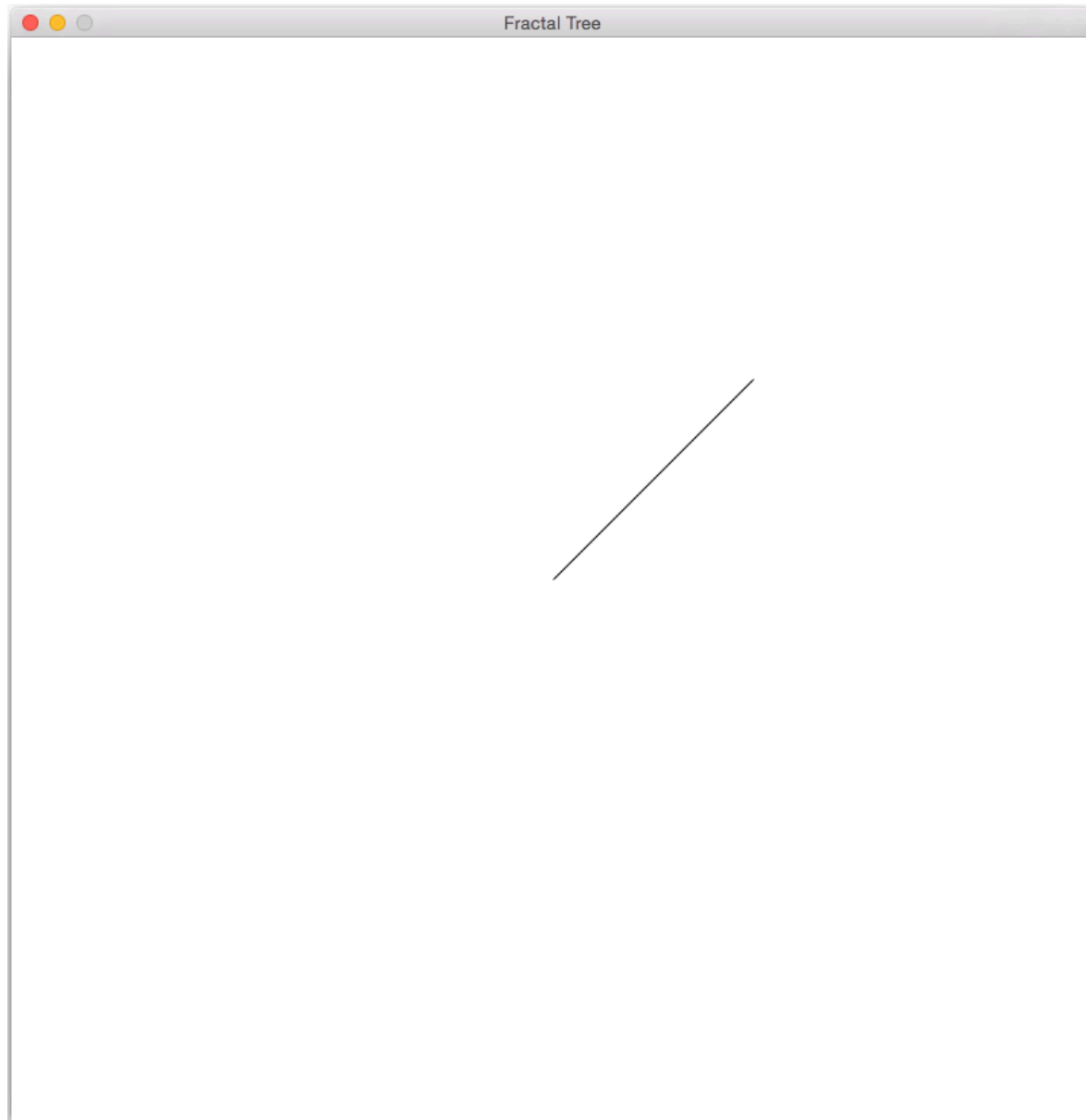
Recursive Trees



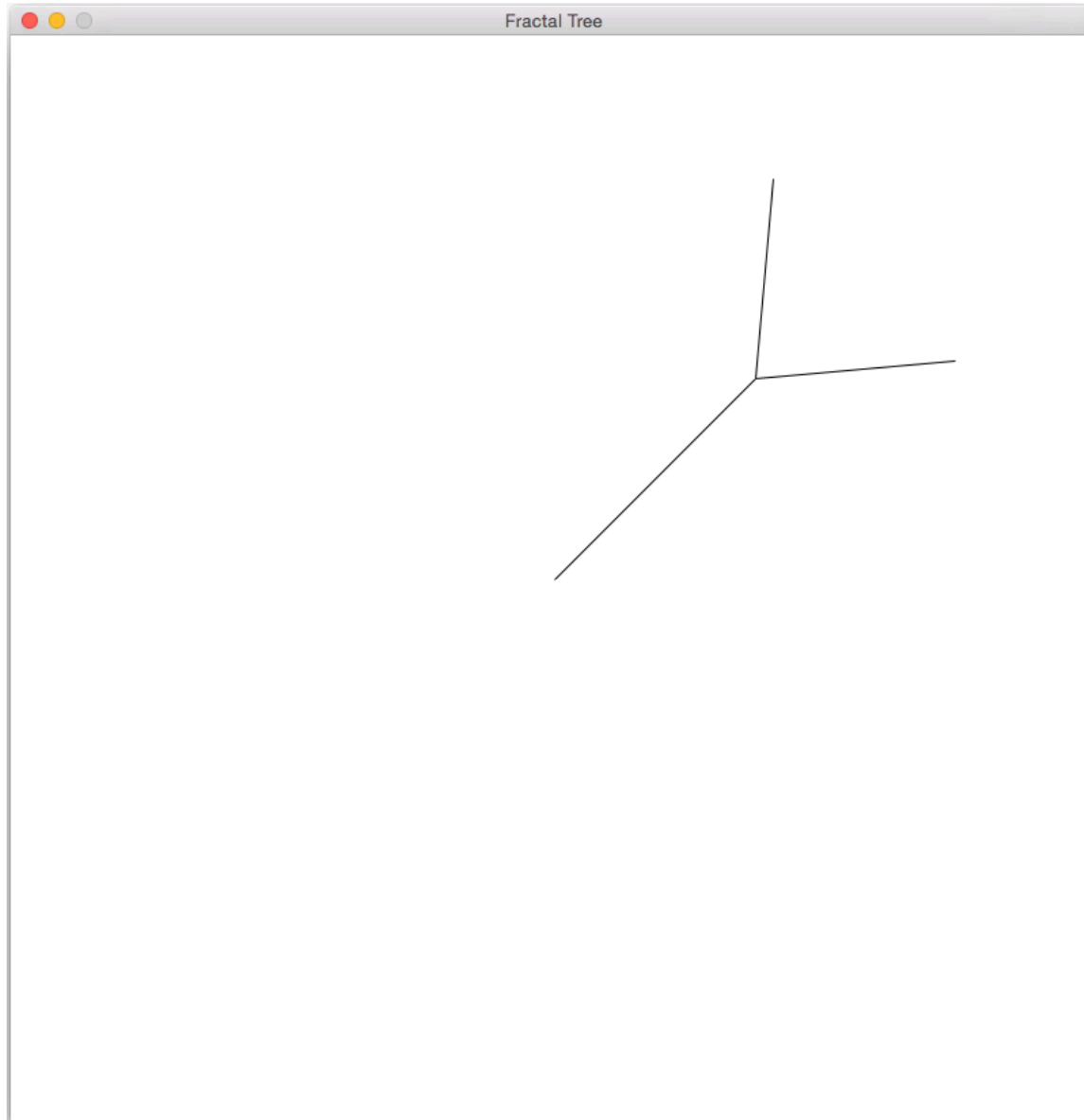
```
draw_tree(win, 0, 400, 750, 210, -math.pi/2)
```



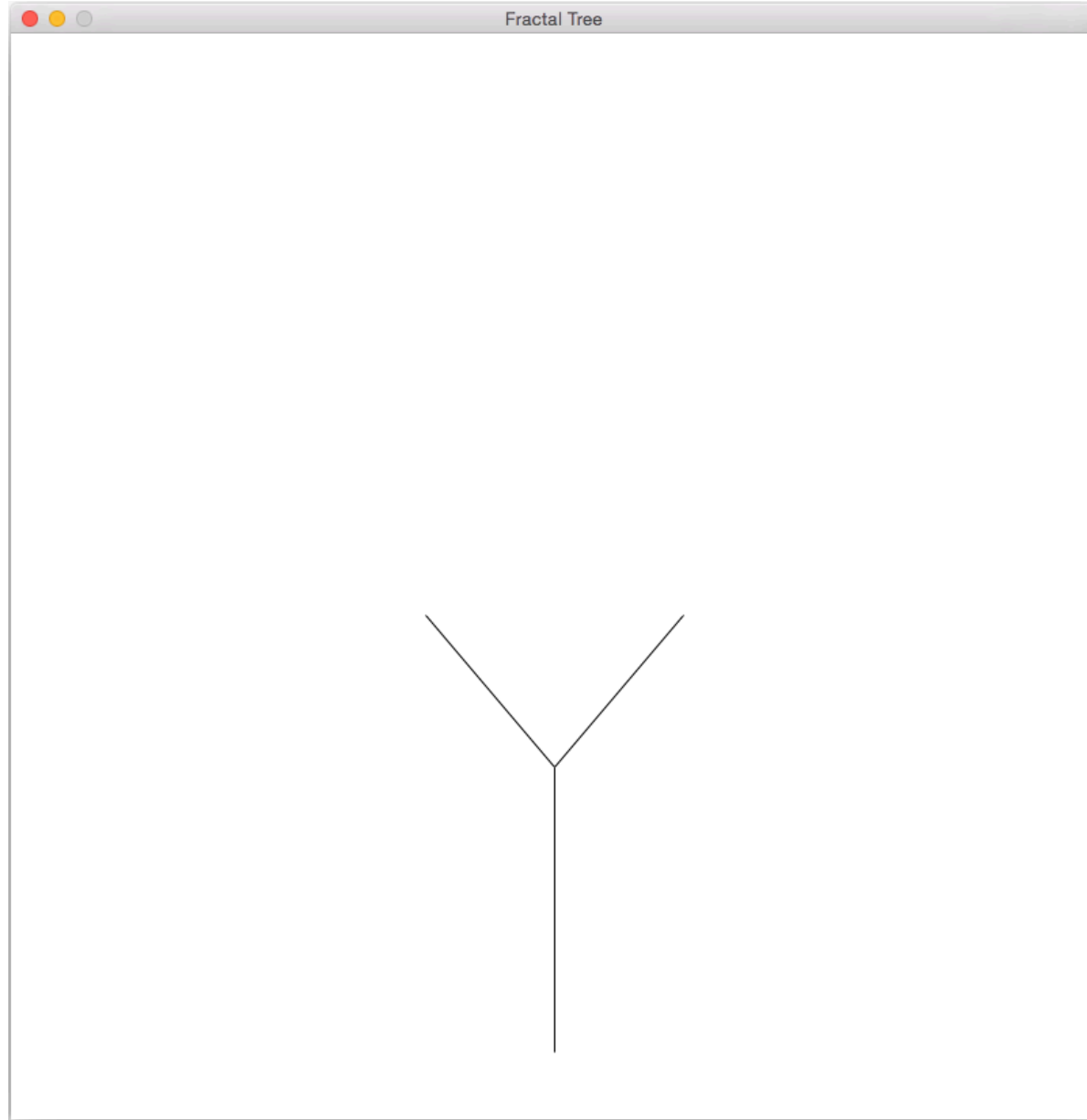

```
draw_tree(win, 0, 400, 400, 210, -math.pi/4)
```



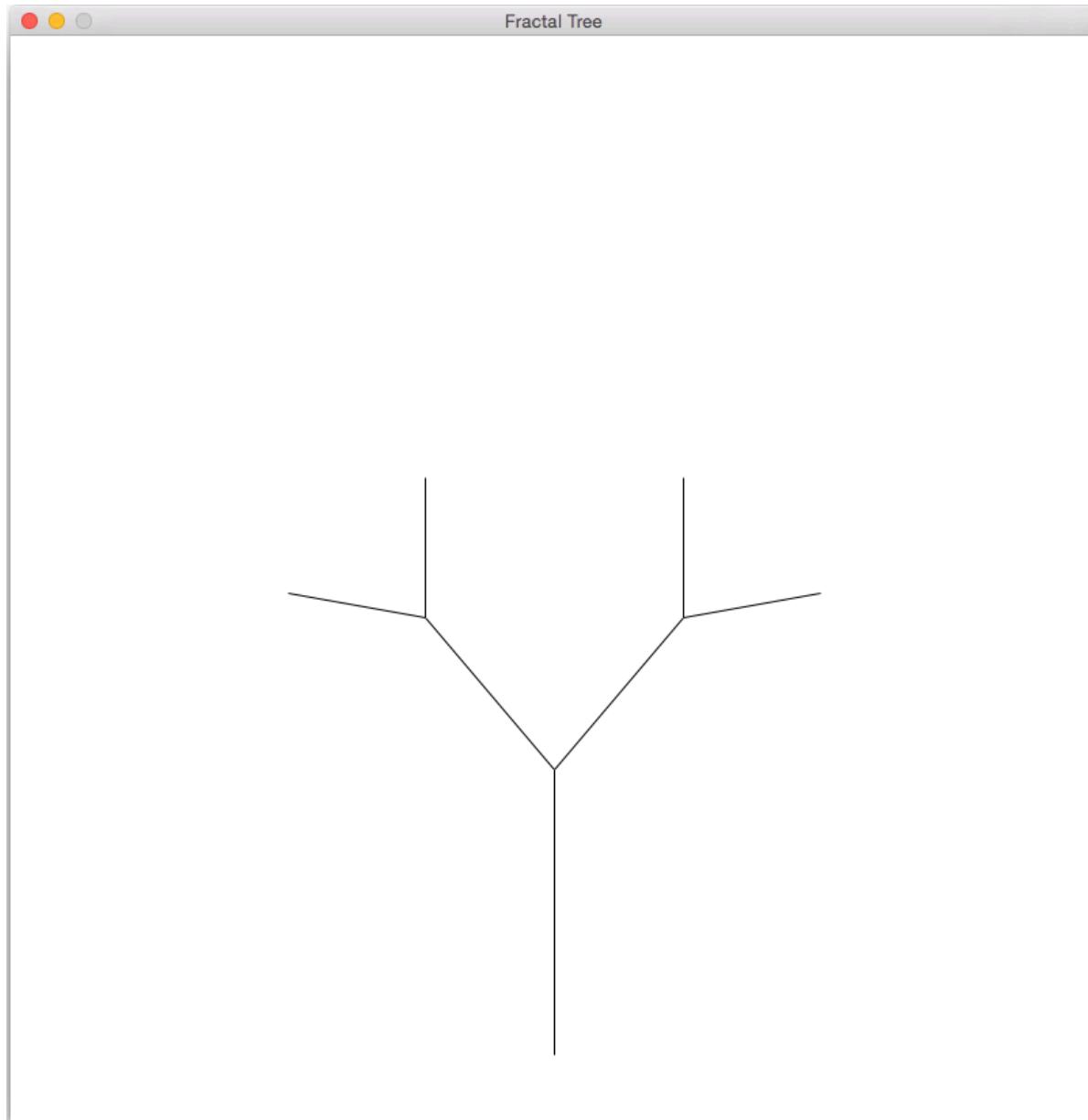
```
draw_tree(win, 1, 400, 400, 210, -math.pi/4)
```



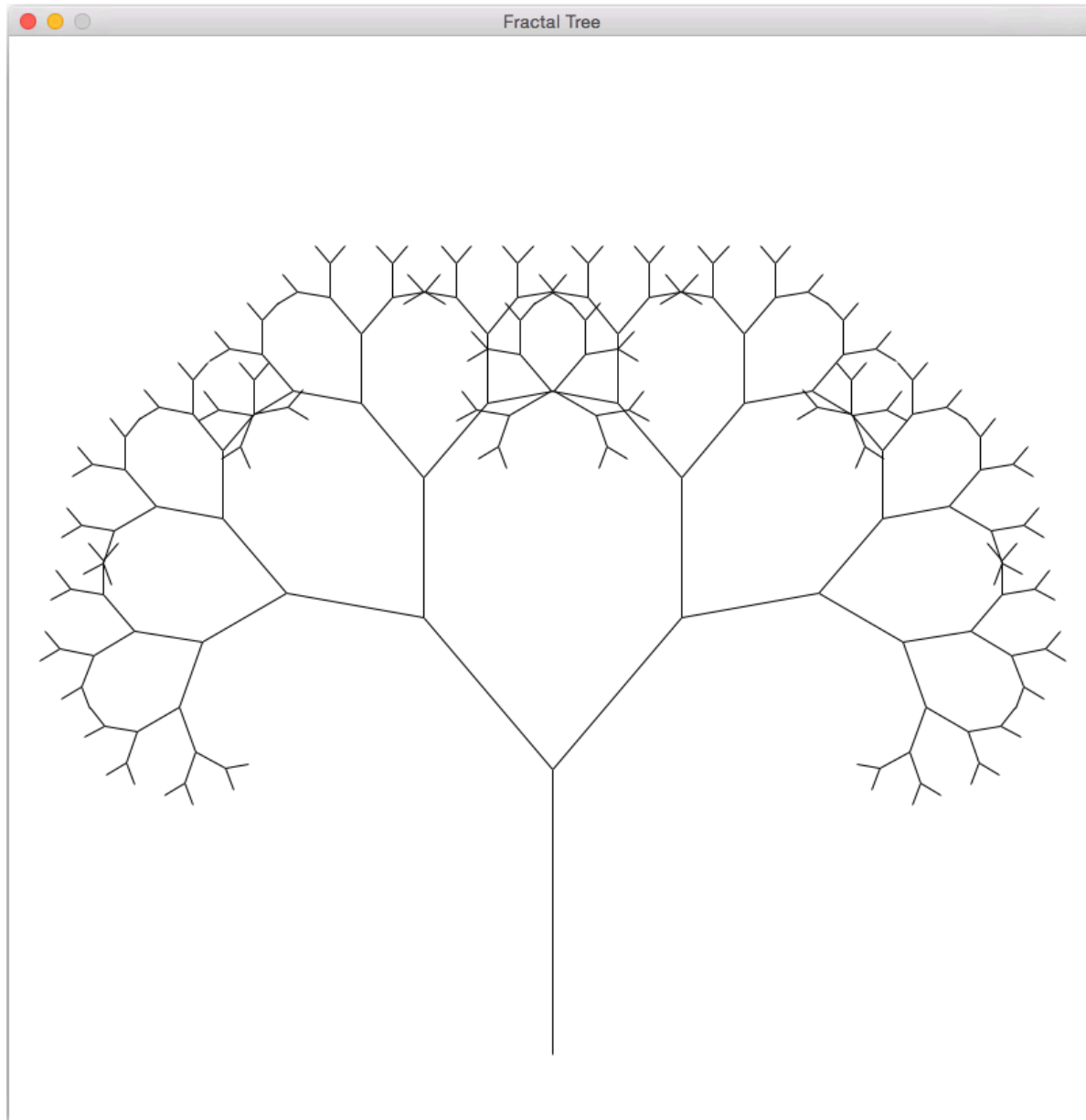
```
draw_tree(win, 1, 400, 750, 210, -math.pi/2)
```



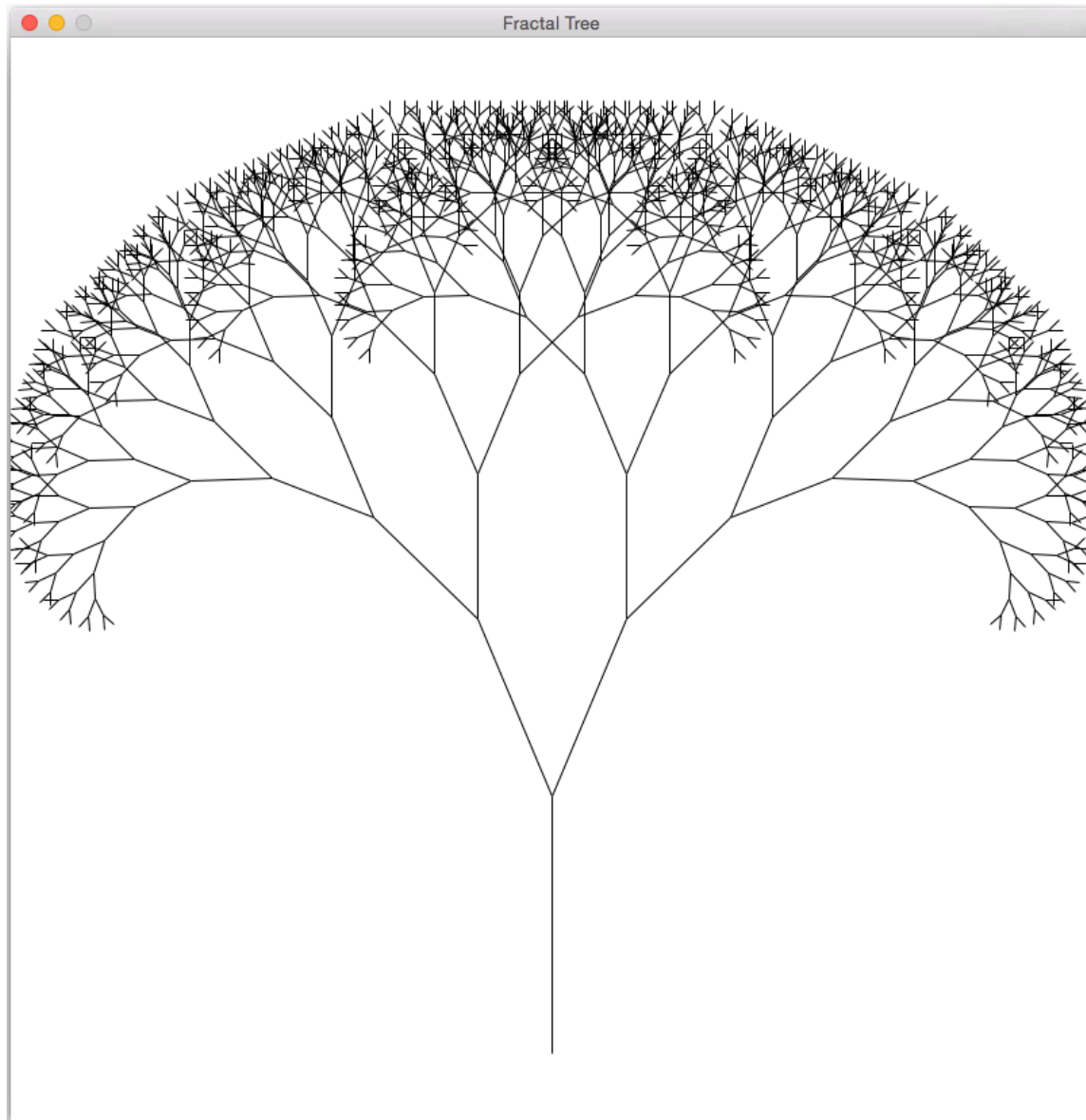
```
draw_tree(win, 2, 400, 750, 210, -math.pi/2)
```



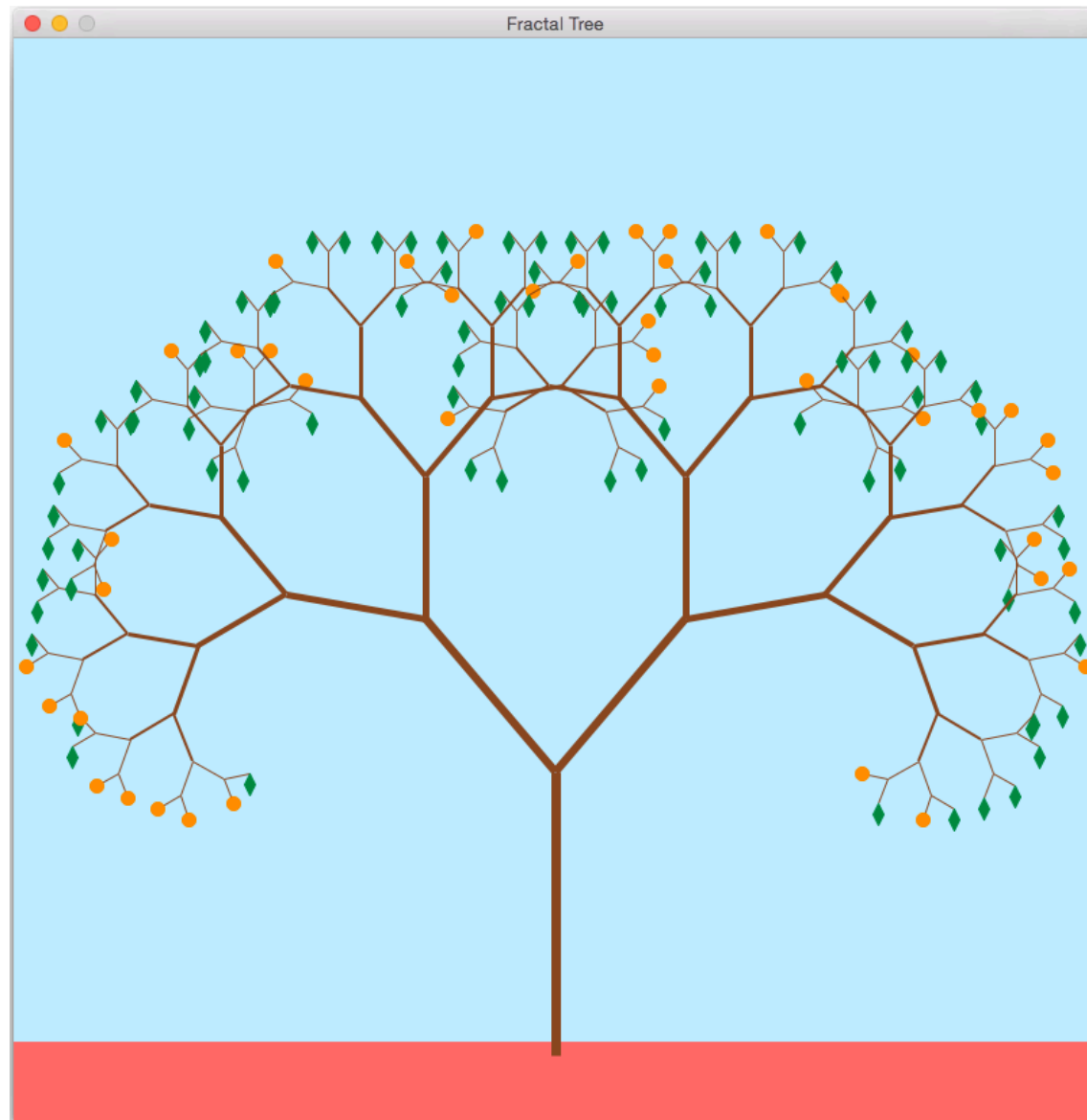
```
draw_tree(win, 7, 400, 750, 210, -math.pi/2)
```



Order = 10

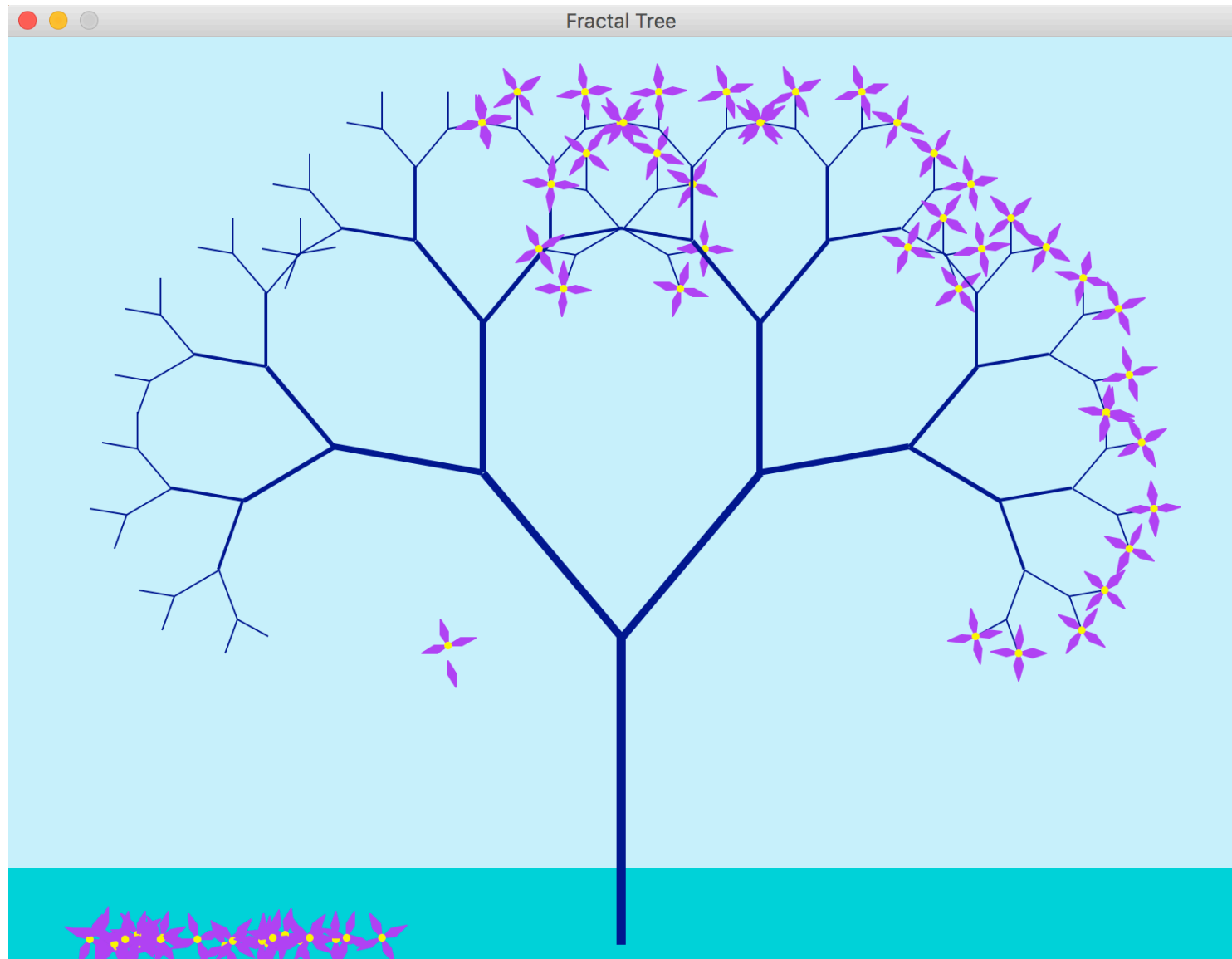


Example with oranges and leaves at the base case



Example with falling flowers

```
flwr = Flower(x,y)  
flwr.draw(window)
```



Example with falling flowers

