Notes from Quiz 4

- Declare variables once
- Once declared, reference by name
- Do not keep redeclaring them!
- Arrays need loops
- Array type has [] following the basic item type
  - int[], float[], Square[]
- Loop indices and array indices should be integers
- nums[i] = 2*nums[i];
- nums[i] = nums[2*i];
- Constructor has no return type
- Constructor should take parameters
- Function parameters and return types!

Odds and Ends

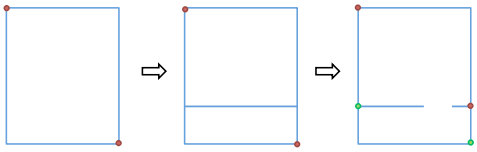
- Load an image ONCE
  - loadImage() in setup() (it's slooooow)
  - use image() to render the image obj in draw()
- Constructor overload
  - We are going to call your constructor(s)!
- Transformations are drawing-related commands!
- Drawing does not depend on global variables
  - If your fish needs anything, it should be stored in the object

Review

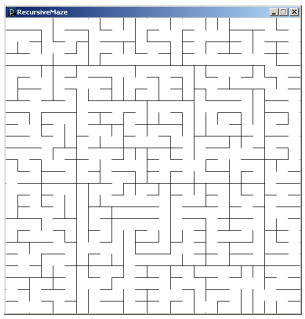
- Recursion (recursive function)
  - a function that calls itself
  - base case
  - reduction of the work to a smaller instance
- Rotation ccw in Processing – negative angle

Creating a maze, recursively

1. Start with a rectangular region defined by its upper left and lower right corners
2. Divide the region at a random location through its more narrow dimension
3. Add an opening at a random location
4. Repeat on two rectangular subregions



Inspired by http://weblog.jamisbuck.org/2011/1/12/maze-generation-recursive-division-algorithm



Examples

- recursive sum
- recursive sum with array
- recursive findMax

Lindenmayer System

- A formal grammar developed to model the development of biological systems
- Generates strings that represent movements
- When traced in the plane, produce remarkable lifelike plant systems
- Components
  - An alphabet (a set of symbols)
  - An axiom or start string
  - A rule set that defines substitutions

L-system Example

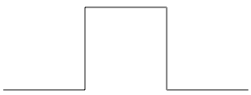
- Alphabet: {A, B}
- Axiom: A
- Rules
  1. {A –> AB}
  2. {B –> A}
- Generation:
  1. A axiom
  2. AB rule 1
  3. ABA rule 1&2
  4. ABAAB rule 1&2
  5. ABAABABA rule 1&2
- All symbols that have available rules are substituted
- Substitutions are simultaneous

Turtle Graphics

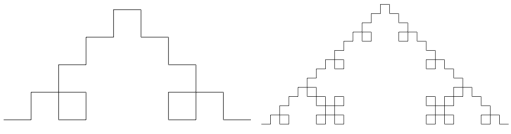
- Imaginary turtle with a pen
- Moves in the plane
  - Forward
  - Turn left
  - Turn right
- Traces with the pen as it moves
- Can put the pen up or down
  - Pen up: no trace
  - Pen down: trace

L-systems Example

- Alphabet: {F}
- Axiom: F
- Rules
  1. {F –> F+F-F-F+F}
- Interpretations:
  1. F Forward (pen down)
  2. + Turn left (pen up)
  3. - Turn right (pen up)

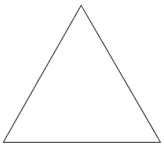


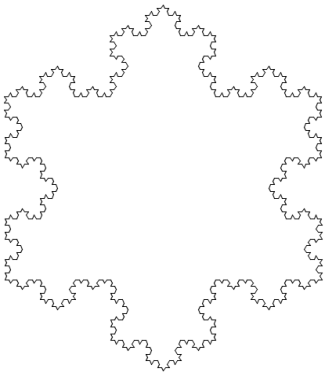
3 and 5 Iterations



Koch Snowflake

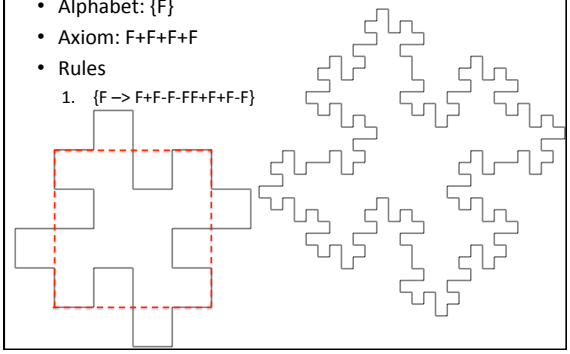
- Alphabet: {F}
- Axiom: F++F++F
- Rules
  1. {F –> F-F++F-F}



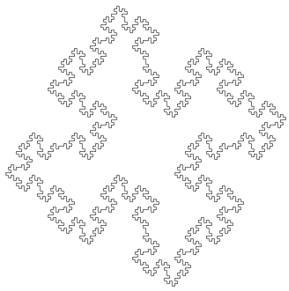


Quadratic Flake

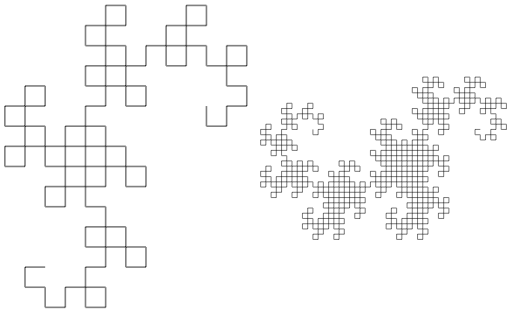
- Alphabet: {F}
- Axiom: F+F+F+F
- Rules
  1. {F –> F+F-F-FF+F+F-F}



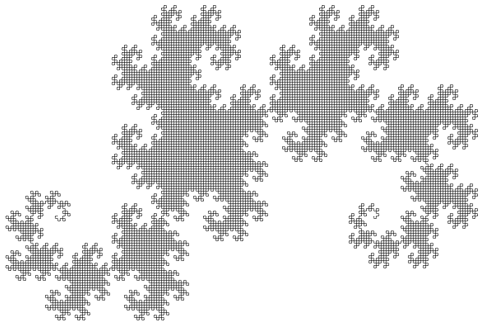
4 Iterations



Heighway Dragon (8 and 11 iterations)



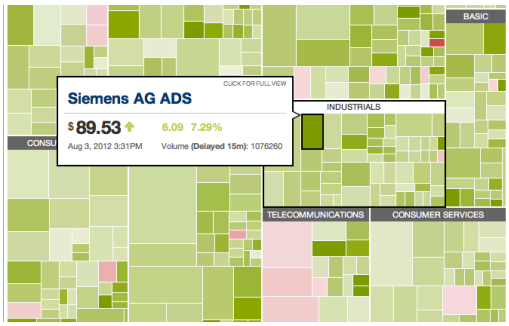
15 Iterations



Plants

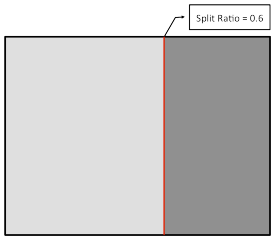
- Alphabet {F}
- Axiom: F
- Rules:
  1. {F –> F[-F]F[+F]F}

Treemap



Recursive Subdivision

- Decide on a split ratio
- Find the sum of all n values
- Sort the values
- Select the first k values that sum up to the split ratio (<= 0.6*sum)
- Allocate these k values to the corresponding split and the remaining n-k to the other
- Recurse when any split contains more than one value



Obama speach