New Groups

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Frank	
Gian	
Jasper	1
Michael	
Rehan	
Dana	2
Evan	
Khuong	
Krzysztof	

Doug	3
Sam	
Zach	
Brandon	4
Lucas	
Shreya	
Vika	

Tree Assignment

- Group development and design of solution …
  - Discussion and design for algorithms, data structures, program structures, error handling, intermediate and final testing plans
  - Help each other with debugging
    - Generally focus your discussions at the algorithmic level
    - don't give your solution for logic errors too easily, instead give your group mates some hints to help them figure out the problems themselves
- Individual Code and report : each student must turn in unique code and report
    - You may have your own design different from your group's, but everybody should contribute to group discussion and development

HW 5 – Build and Render Trees Specified by LSystems

- For each tree grammar, your program needs to
  - Read it from a file and save it in proper data structure
  - generate a string representing a tree as specified by the grammar, for a desired iteration number
  - generate point coordinates and point adjacency information needed for rendering the tree with line-type GL primitives
  - Render the tree with a proper size and orientation in the display window

Example

- Tree grammar in lsys1.txt, from WPI, w/o the comment part

  len: 1

  iter: 5

  rot: 25.7 25.7 25.7

  start: F

  F: F[+F]F[-F]F

- string after iter 1: F[+F]F[-F]F //color coded to show string rewriting
- string after iter 2: F[+F]F[-F]F[+F[+F]F[-F]F] F[+F]F[-F]F[-F[+F]F[-F]F] F[+F]F[-F]F
- …
- (recursion can be used to avoid explicit generation of strings. But I recommend not using recursion in your first LSystem program.)

Geometric Interpretation of LSystem Symbols

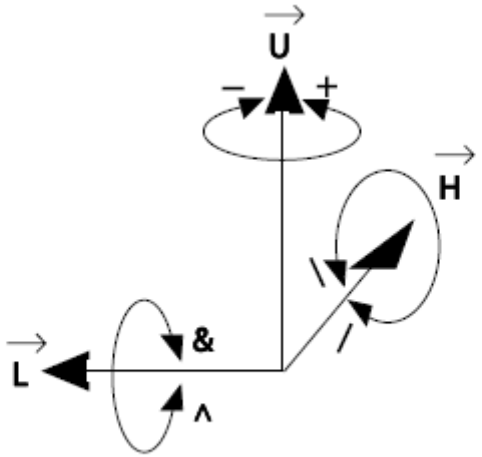


Figure 1.18: Controlling the turtle in three dimensions

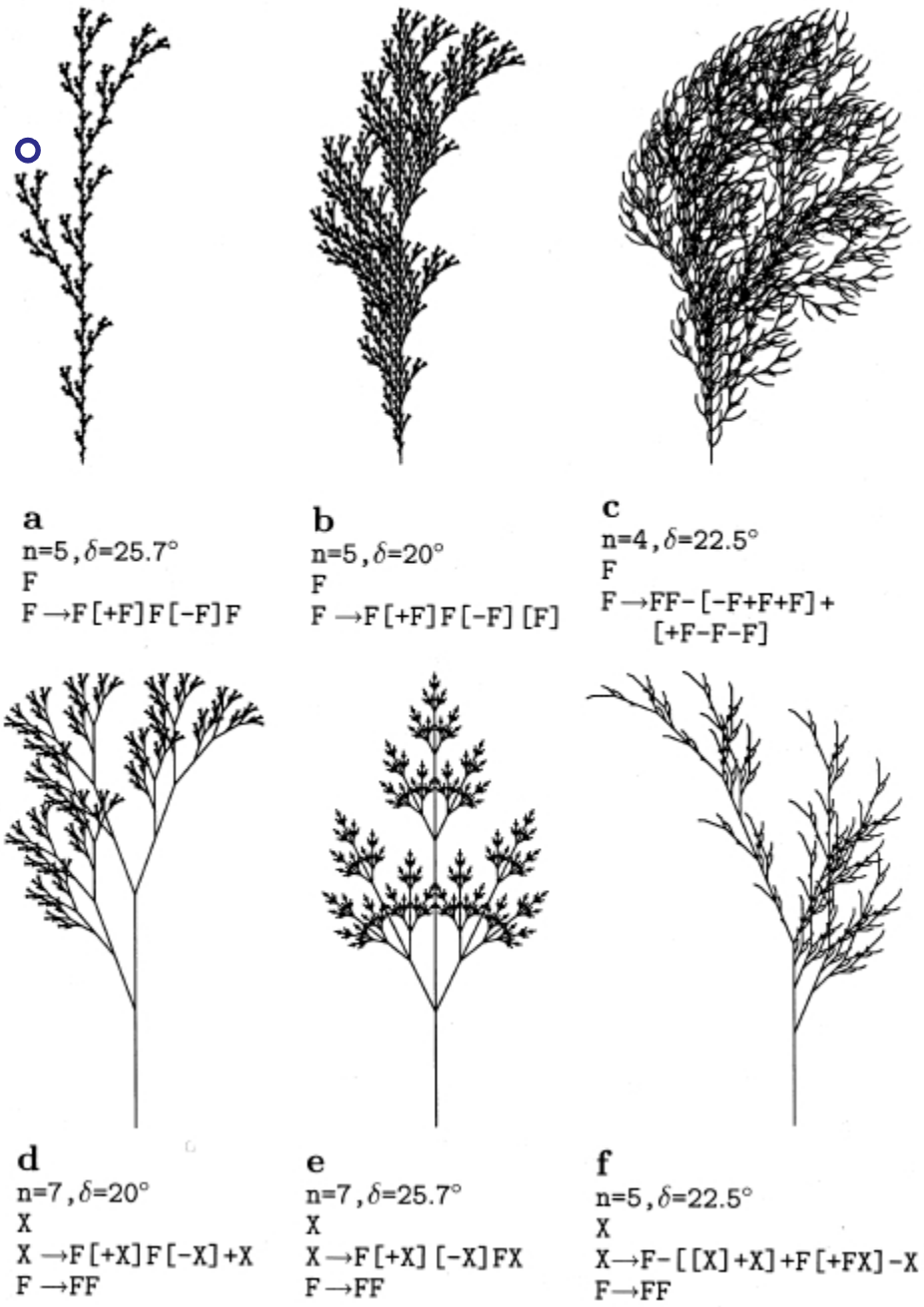
$+(\theta)$	Turn left by angle θ around the $\vec{U}$ axis.
$-(\theta)$	Turn right by angle θ around the $\vec{U}$ axis.
$\&(\theta)$	Pitch down by angle θ around the $\vec{L}$ axis.
$\wedge(\theta)$	Pitch up by angle θ around the $\vec{L}$ axis.
$/(\theta)$	Roll left by angle θ around the $\vec{H}$ axis.
$\backslash(\theta)$	Roll right by angle θ around the $\vec{H}$ axis.
$\vert$	Turn 180° around the $\vec{U}$ axis. This is equivalent to $+(180)$ or $-(180)$.

- A turtle's current state has a position and orientation, which can be represented by a 4x4 transformation matrix
- Axis naming convention in LSys:
  - H: Heading, x-axis
  - L: Left, y-axis
  - U: Up, z-axis

Geometric Interpretation of LSystem Symbols

$F(s), G(s)$	Move forward a step of length s and draw a line segment from the original to the new position of the turtle.
$f(s), g(s)$	Move forward a step of length s without drawing a line.
[	Push the current state of the turtle (position, orientation and drawing attributes) onto a pushdown stack.
]	Pop a state from the stack and make it the current state of the turtle. No line is drawn, although in general the position and orientation of the turtle are changed.

The example should lead to this tree. But how? that is the fun part…



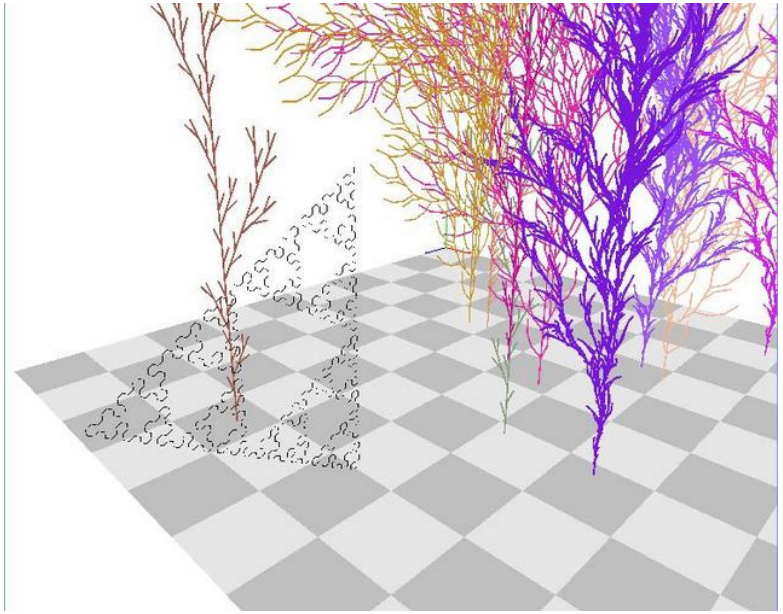
HW 5 – Build and Render Trees Specified by LSystems

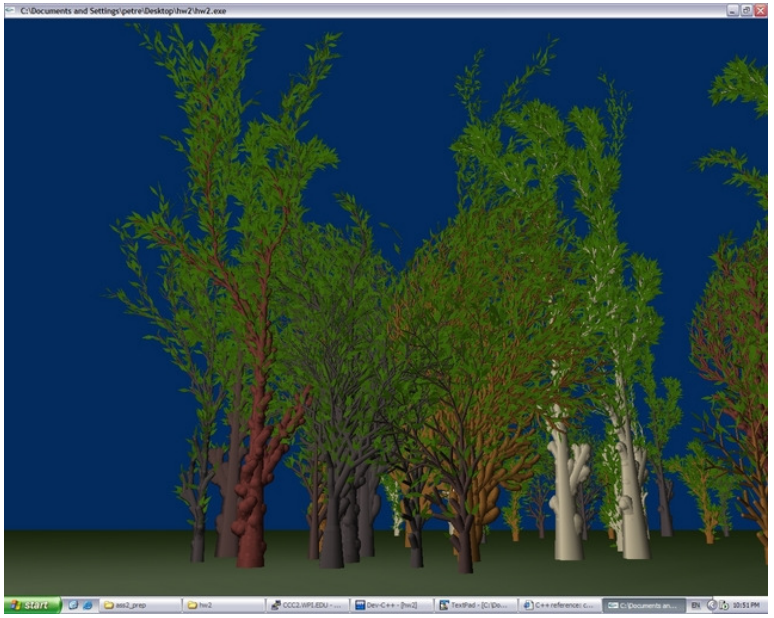
- Required Program functionality
  - The start of your program should lead to the rendering of the tree represented by lsys1.txt
  - User can use key a, b, c, d, e or f to switch to the rendering of lsys1.txt, lsys2.txt, lsys3.txt, lsys4.txt, lsysSier.txt (Sierpinski gasket), or yourOwnLsys.txt.
  - User can use space bar to increase the tree iteration number, and key r to reduce the tree iteration number
- Each tree and the Sierpinski Gasket should have a proper size and orientation in the display window

Later Assignment

- In a later assignment, you need to create a park with trees and other 3D objects.
- If you find the rendering of individual trees to be quite slow, you should save tree data (point coordinates, primitive indices) in files which can be used to create a park relatively quickly. Such files are helpful for debug too
- Here is the webpage at WPI with their student course work:

http://web.cs.wpi.edu/~gogo/courses/cs4731_2006b/lsys/





Check out the Following Resources

- Algorithmic Beauty of Plants:
  - Webpage: http://algorithmicbotany.org/
  - Book: http://algorithmicbotany.org/papers/#abop
  - Report and course notes: http://algorithmicbotany.org/papers/#reports

    http://algorithmicbotany.org/papers/sigcourse.2003.html, which has links to our two handouts

    Introduction to modeling with L-systems

    L-systems: from the theory to visual modeling of plants