Recursive Graphs

CSC 212 Final Project

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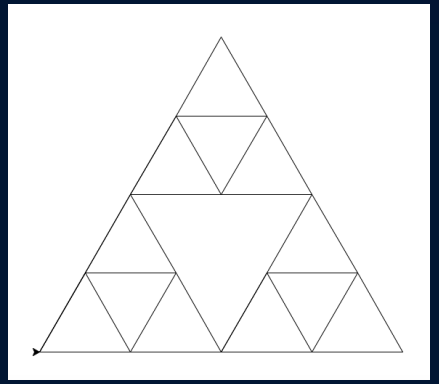
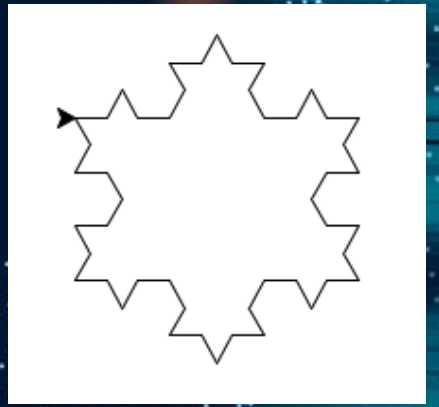
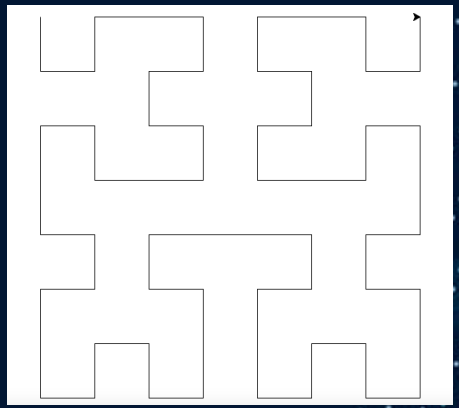
Topic Introduction

- Fractals, shapes within shapes
  - Sierpinski Triangle
  - Koch Snowflake
  - Hilbert Curve







Project Introduction

- Draw fractals using Python's Turtle module
  - How does the Turtle know what to draw?
- Generate drawing commands using recursion in C++
  - One C++ program for every shape
  - Commands are stored into a .csv file

Project Components

01

Python Graphics

02

Sierpinski Triangle

03

Koch Snowflake

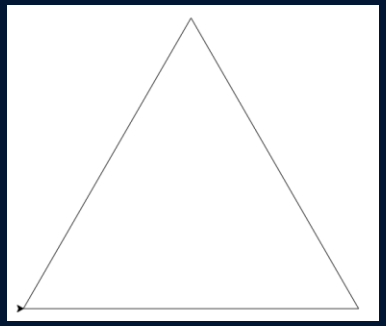
04

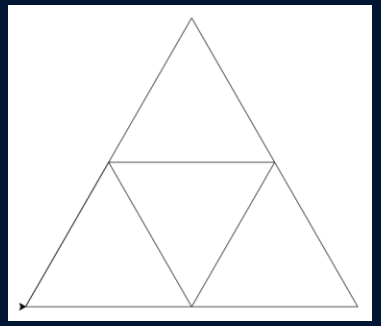
Hilbert Curve

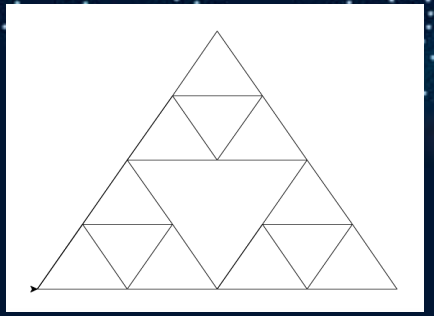
Implementation Of Python Graphics

- Python file handling enables interaction with external files to load or exchange data
- Script reads input file and processes commands to draw shapes using Turtle
- It contains two functions that are called during runtime, open_file and draw_shape

Sierpinski Triangle

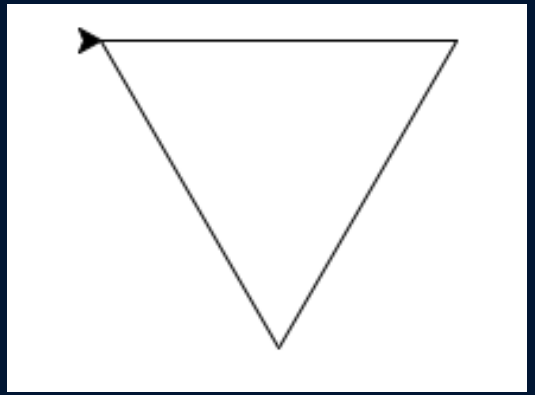


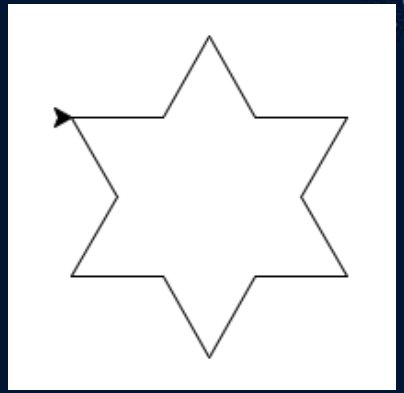


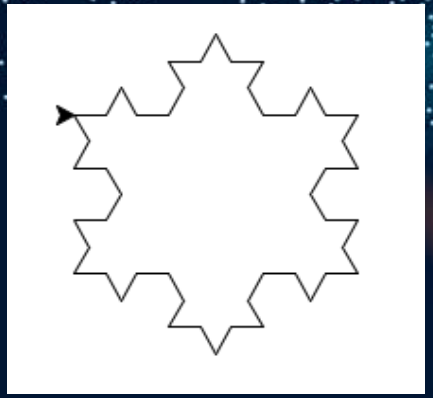


- Start with an equilateral triangle, then connect the midpoints of its sides to form 4 congruent triangles inside the original triangle.
- Remove the center triangle so that the area of the remaining shape is ¾ the area of the original.
- Repeat the process with the remaining triangles an infinite number of times.

Koch Snowflake



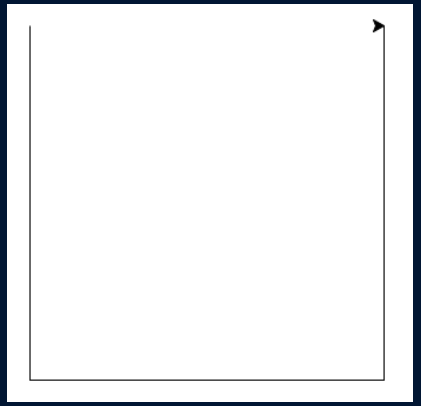


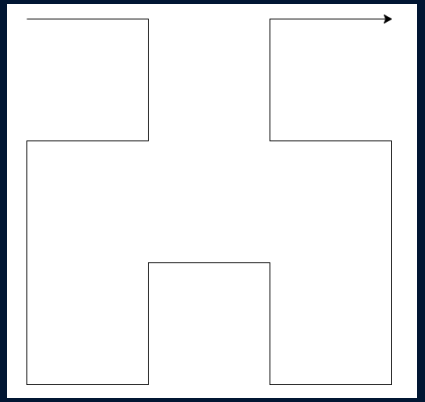


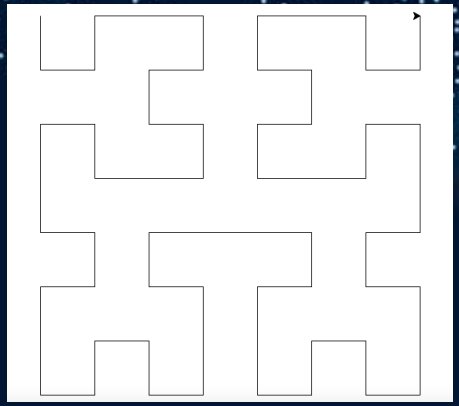
The Koch snowflake can be constructed by starting with a line segment and recursively altering each segment as follows :

- Divide the line segment into three segments of equal length.
- Draw an equilateral triangle that has the middle segment from step 1 as its base and points outward.
- Remove the line segment that is the base of the triangle from step 2.
- Continue this process for each line segment in the curve, for the desired depth.
- Finally, repeat this process 3 times in order to make the snowflake from 3 connected curves.

Hilbert Curve







- Divide a square into a 2x2 grid
- Connect each cell's center with a line segment, except the final connection
  - Basic, level 1 Hilbert Curve
- For greater depth, arrange the level 1 curves as seen in image 2, and connect the adjacent legs
- Rinse and repeat for every complete sub shape to get greater depths

Source Code

Live Demo

Questions?

Thank You!