COMPUTER GRAPHICS REALISM

CONTENT

- TILING THE PLANE
- RECURSIVELY DEFINED CURVES
- KOCH CURVES
- C CURVES
- DRAGONS
- SPACE FILLING CURVES
- FRACTALS
- GRAMMAR BASED MODELS
- TURTLE GRAPHICS
- RAY TRACING

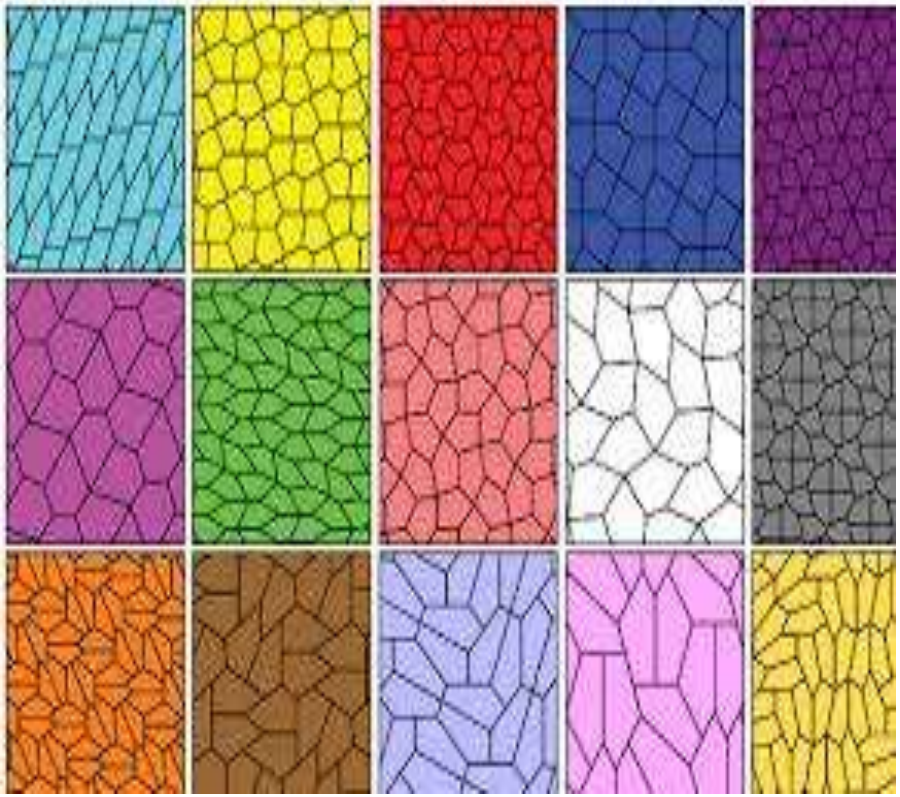
Computer Graphics Realism

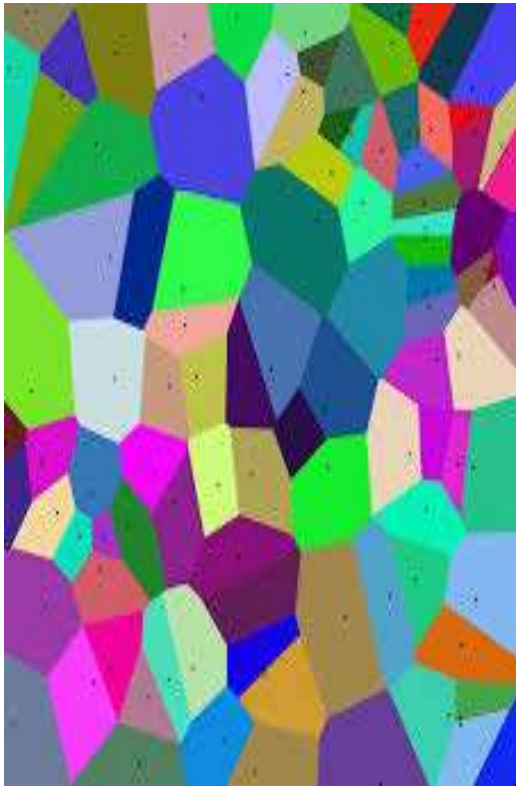
- Image is a visual representation of scene, it represent selected properties of scene to viewer with varying degree of realism.

Tiling the Plane

- Use one or more geometric shapes
- Tessellation(without gaps) of flat surface
- Shape repeated
- Moving infinity
- Covering entire plane
- Used arts,mosaics,wall papers,tiled floor

Tiling the Plane





Tiling the Plane

Tiling the Plane

Types of tiling

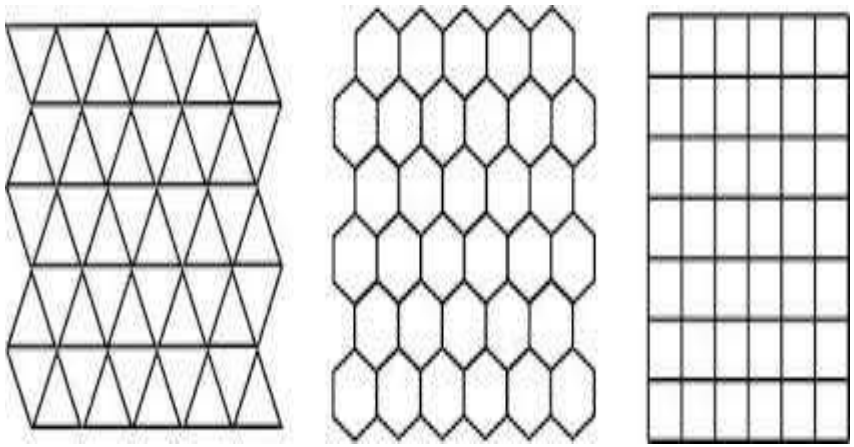
- Monohedral tiling
- Dihedral tiling
- Drawing tiling
- Reptiles

Monohedral tiling

- Based on single polygon
- **Types**

1. Regular tiling
2. Patterns
3. Cario tiling
4. Polymino
5. Polyiamond

Regular Tiling

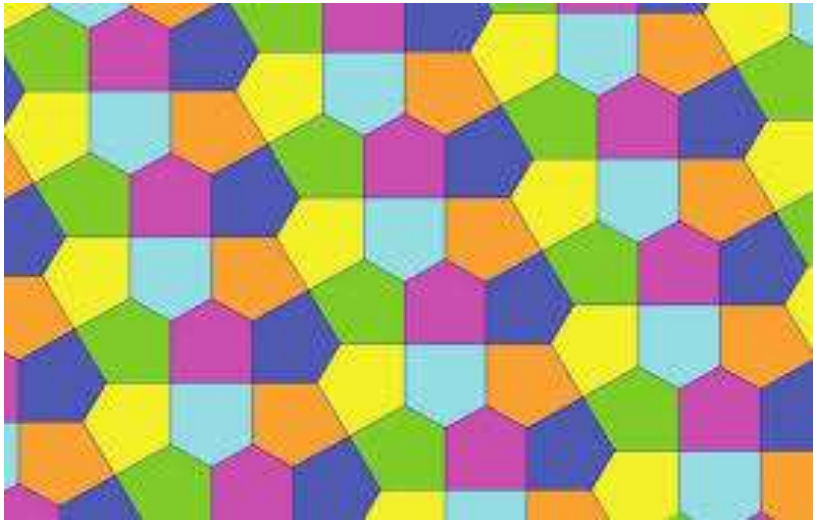


Patterns

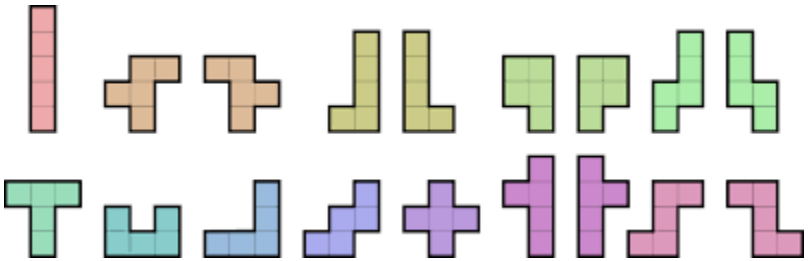
- Shifting the tessellation in particular direction

Cairo tiling

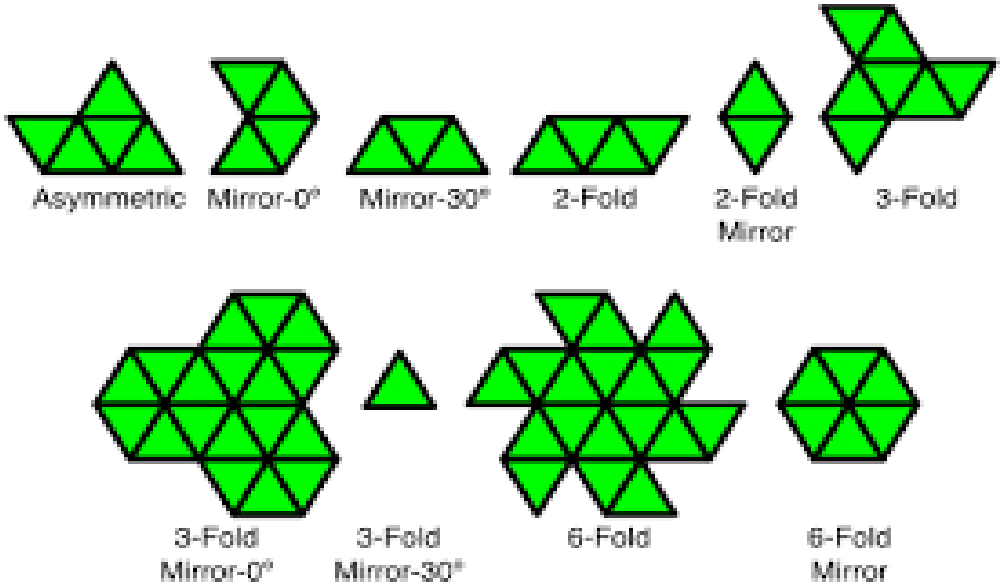
- Four pentagon fit together to form hexagon
- Used to tile the plane
- Many street in cairo,Egypt in this pattern



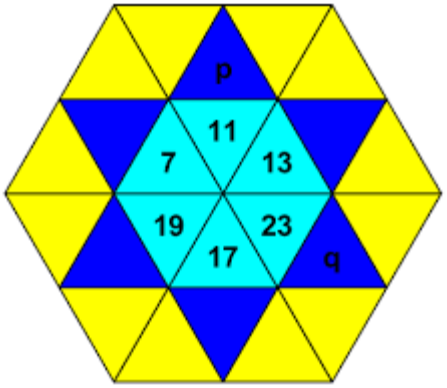
Polymino

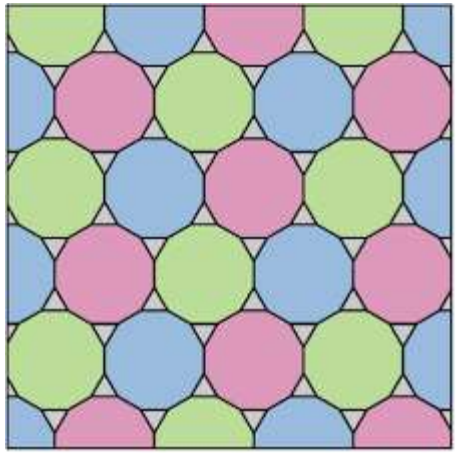


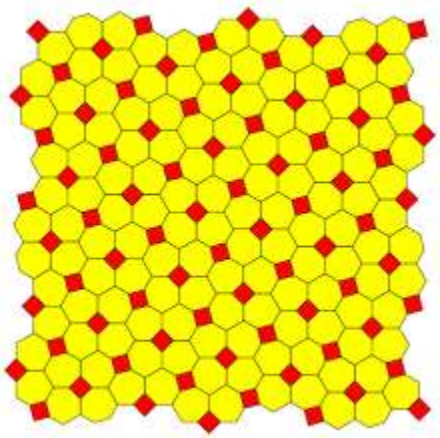
Polyaimonds



Dihedral Tiling

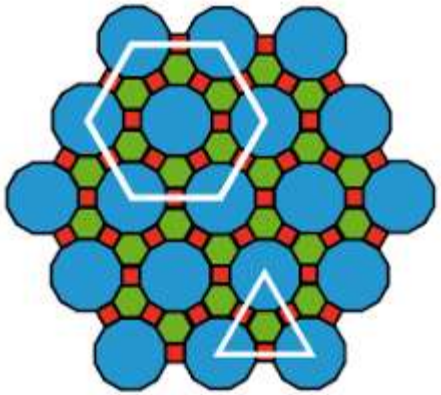






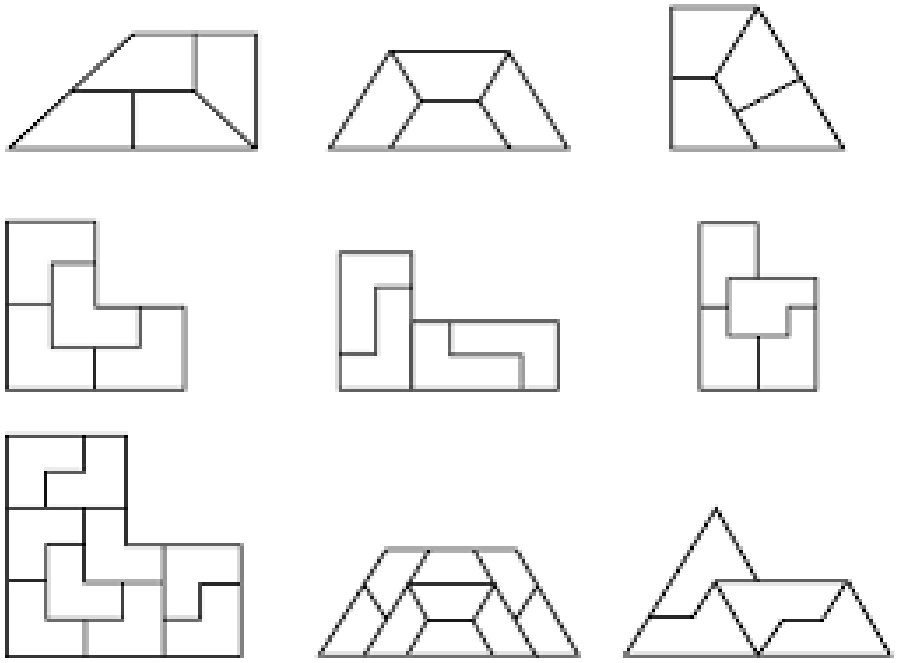
Drawing Tiling

- Large window setup
- Tiles grouped together into single figure
- Single figure drawn again and again
- Non periodic figure include
- Small to large and large to small



Reptiles

- Non periodic tiling
- Based on square, equilateral triangle



Application of tiles

Fractals

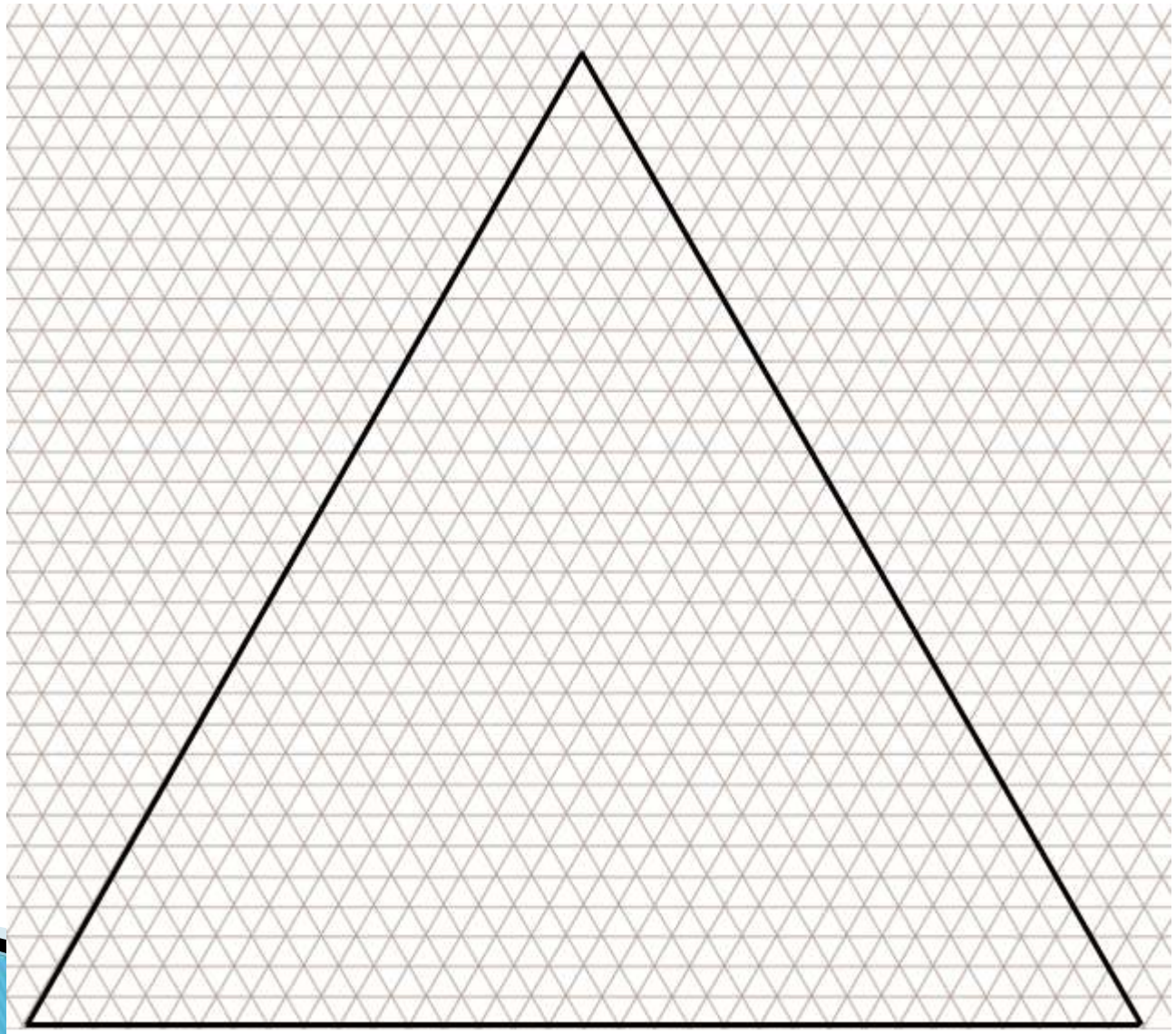
- A fractal is a never-ending pattern.
- Fractals are infinitely complex patterns that are self-similar across different scales.
- They are created by repeating a simple process over and over in an on-going feedback loop.

Types of Fractals

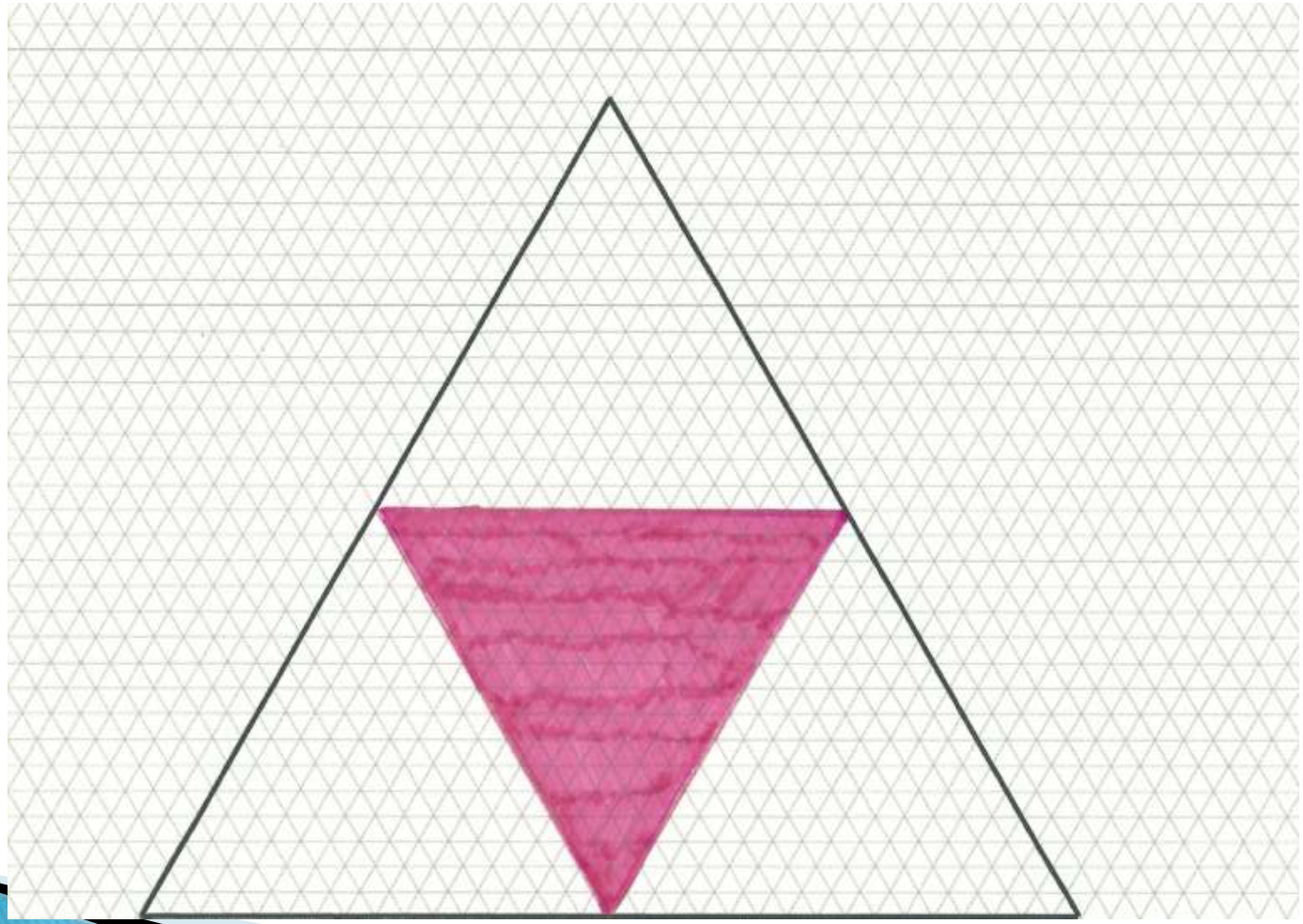
- Self Similar fractals
- Self Affine fractals
- Invariant fractals

Self Similar fractals

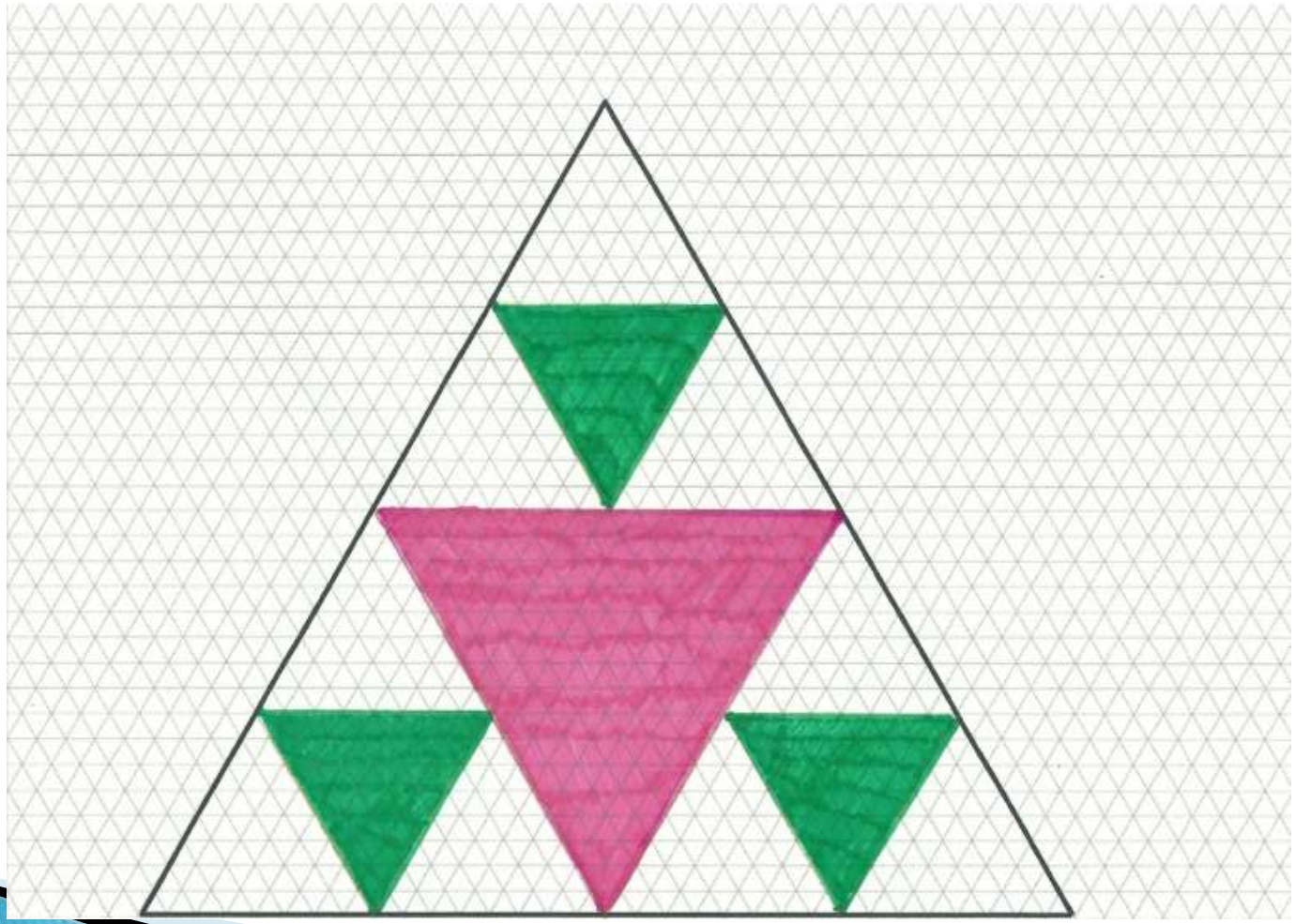
- Geometric figure is self similar
- Fractals appear identical at different scales



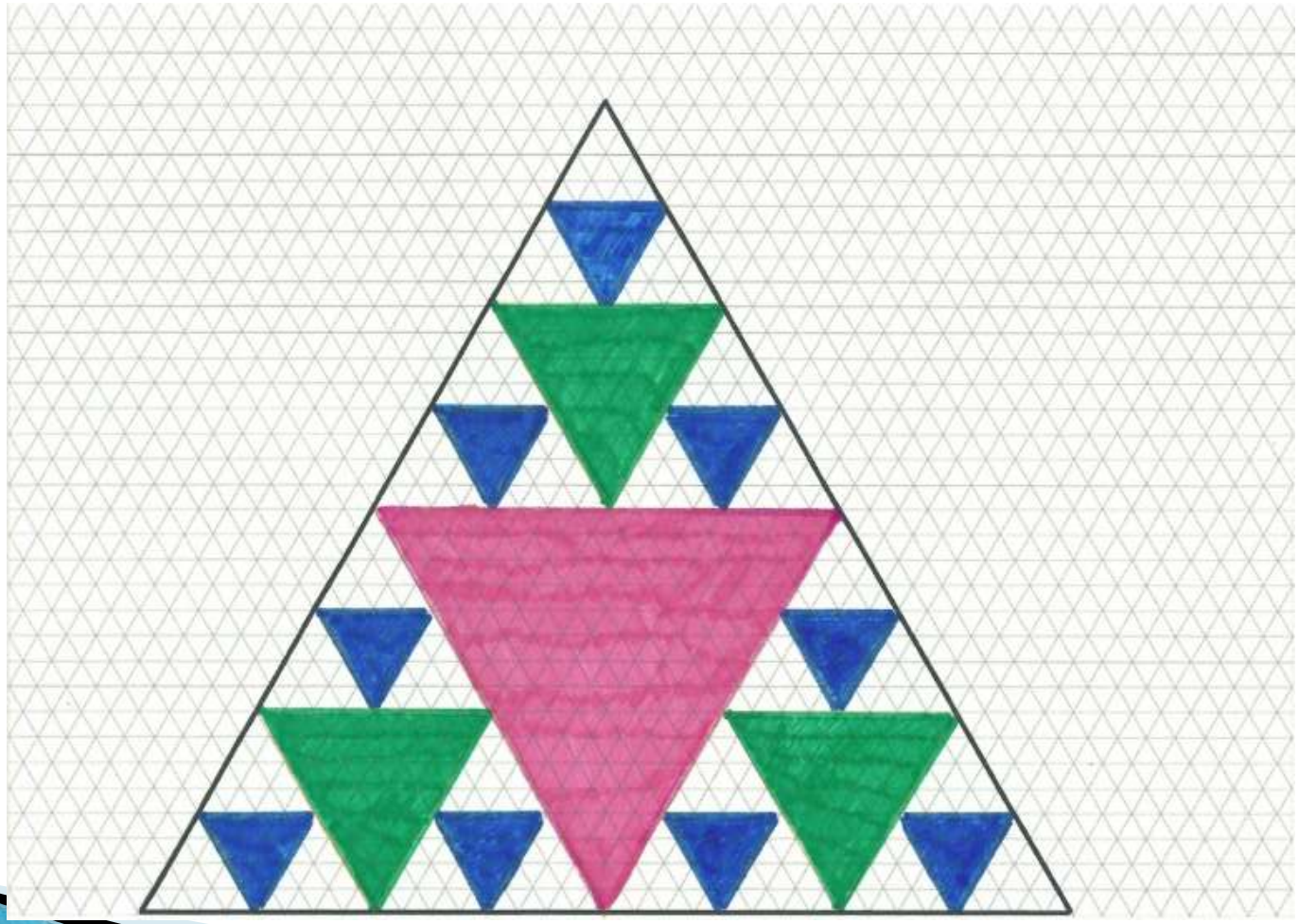
Iteration 1



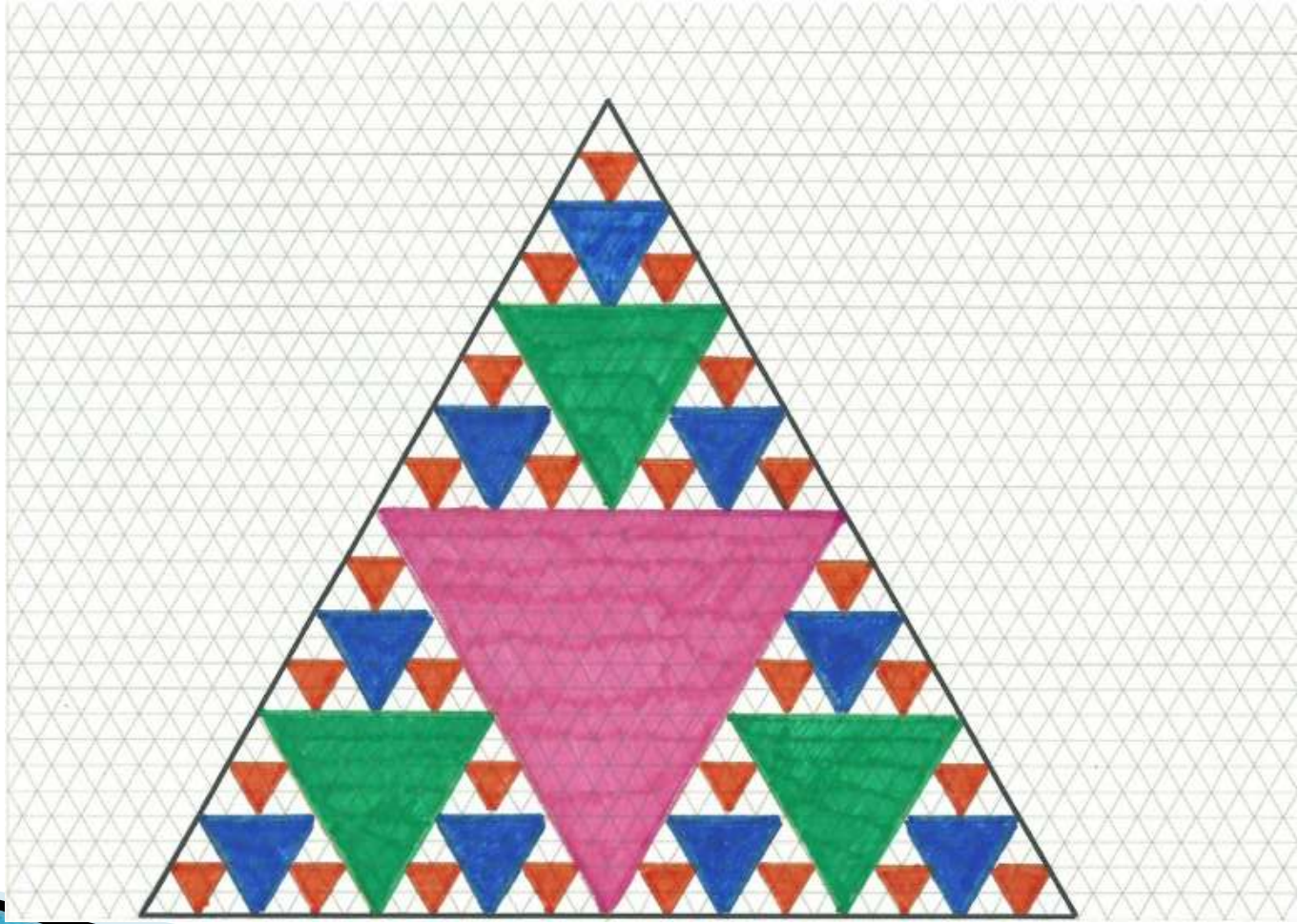
Iteration 2



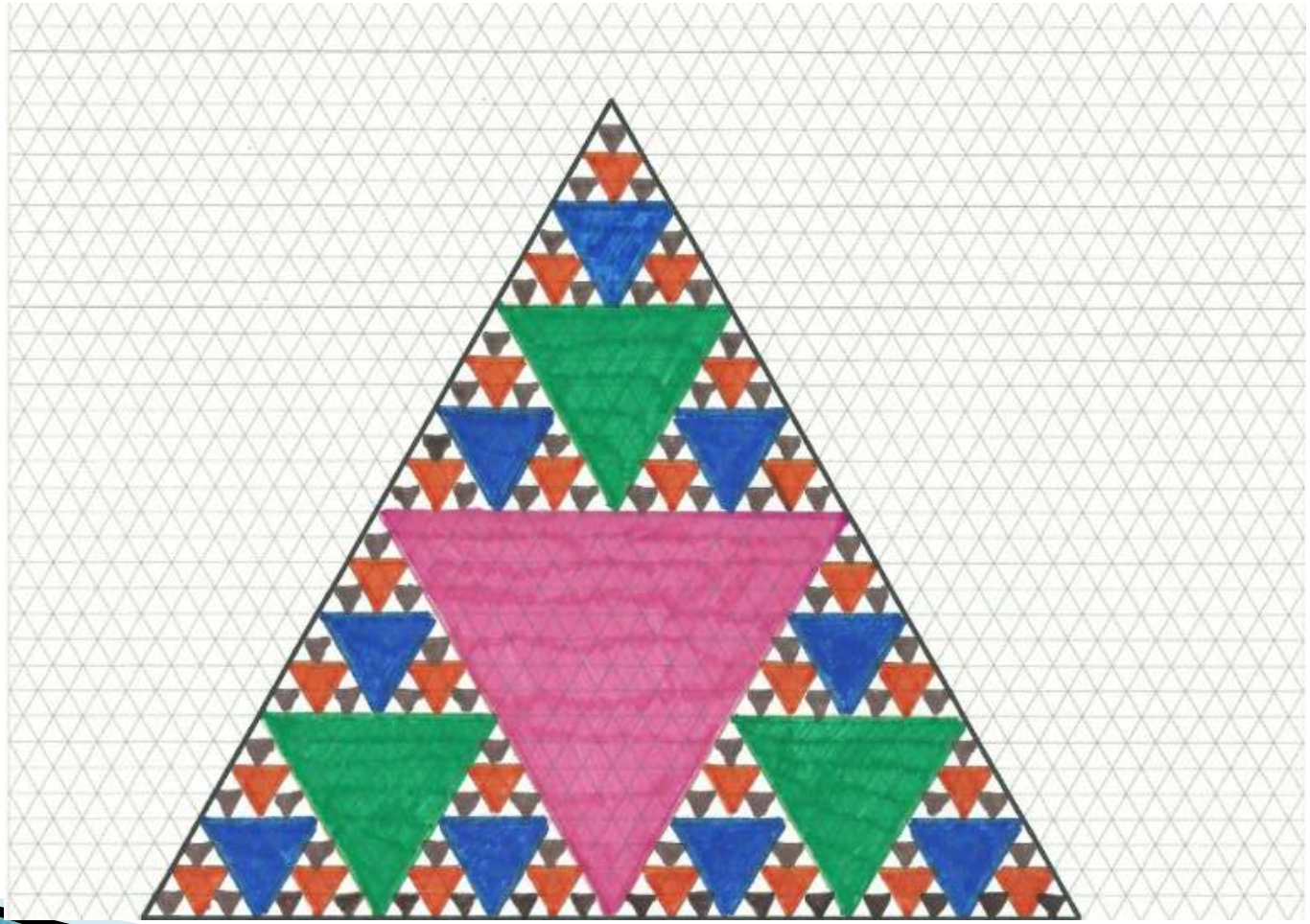
Iteration 3



Iteration 4



Iteration 5



Self similar fractal usage

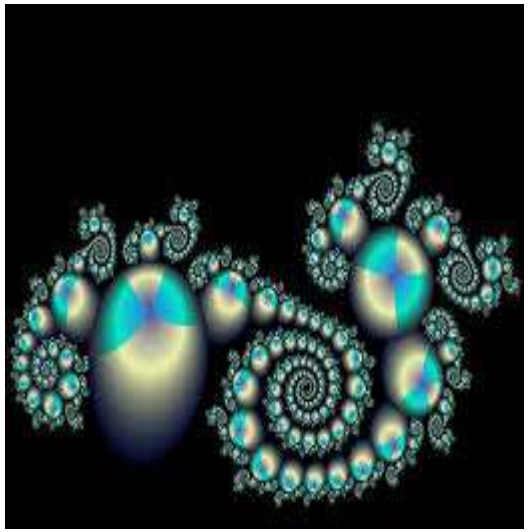
- Model trees,shrubs,plants

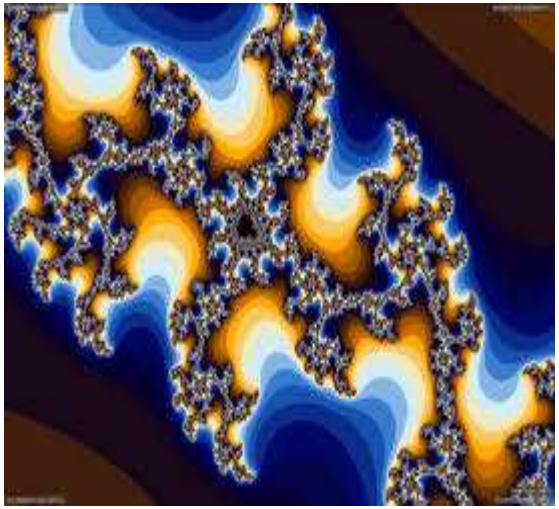
Self Affine fractals

- Fractal appear approximately identical at different scales
- Model water,clouds,terrain

Invariant fractals

- Non linear transformation





Recursively defined curves

- Curves created by iterations
- Formulas repeated with slightly different values over and over again

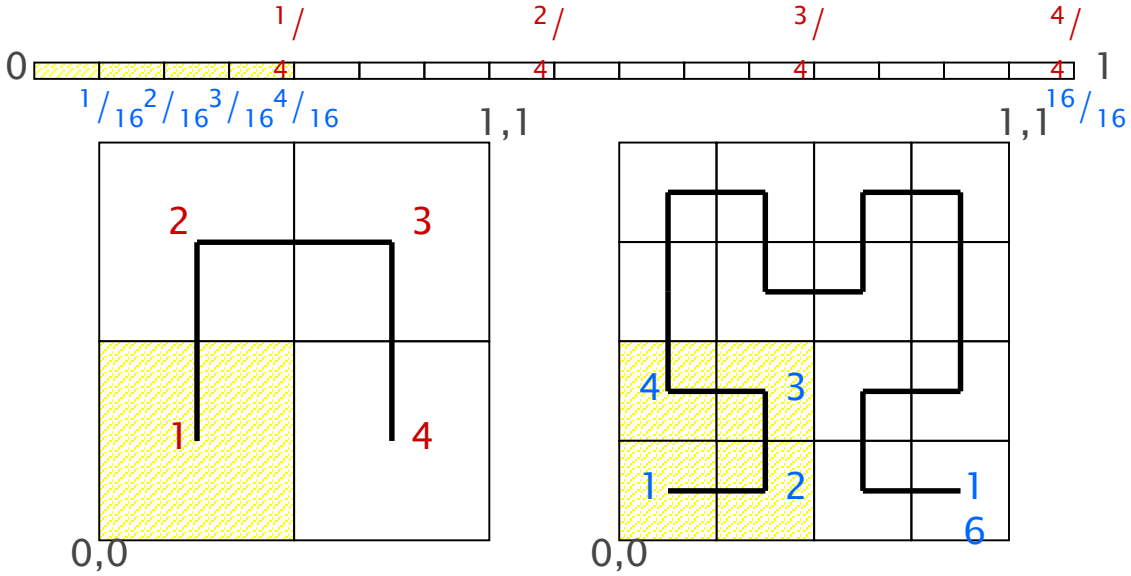
Types

- Hilberts Curve
- Koch Curve
- Dragon Curve
- Space filling Curve/Piano Curve
- C Curve

Hilberts Curve

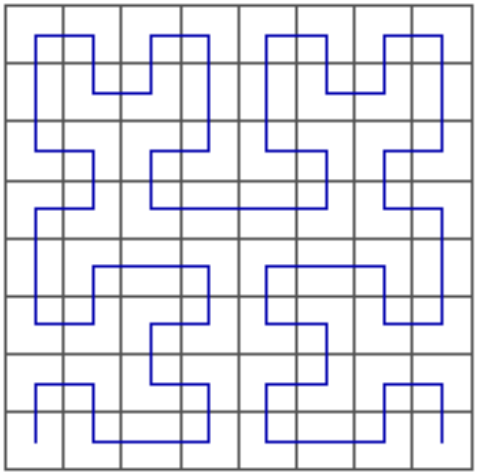
- It was described by the German mathematician David Hilbert in 1891.
- The Hilbert curve is a space filling curve.
- It visits every point in a square grid with a size of 2×2, 4×4, 8×8, 16×16, or any other power of 2.

The Hilbert curve: geometric generation



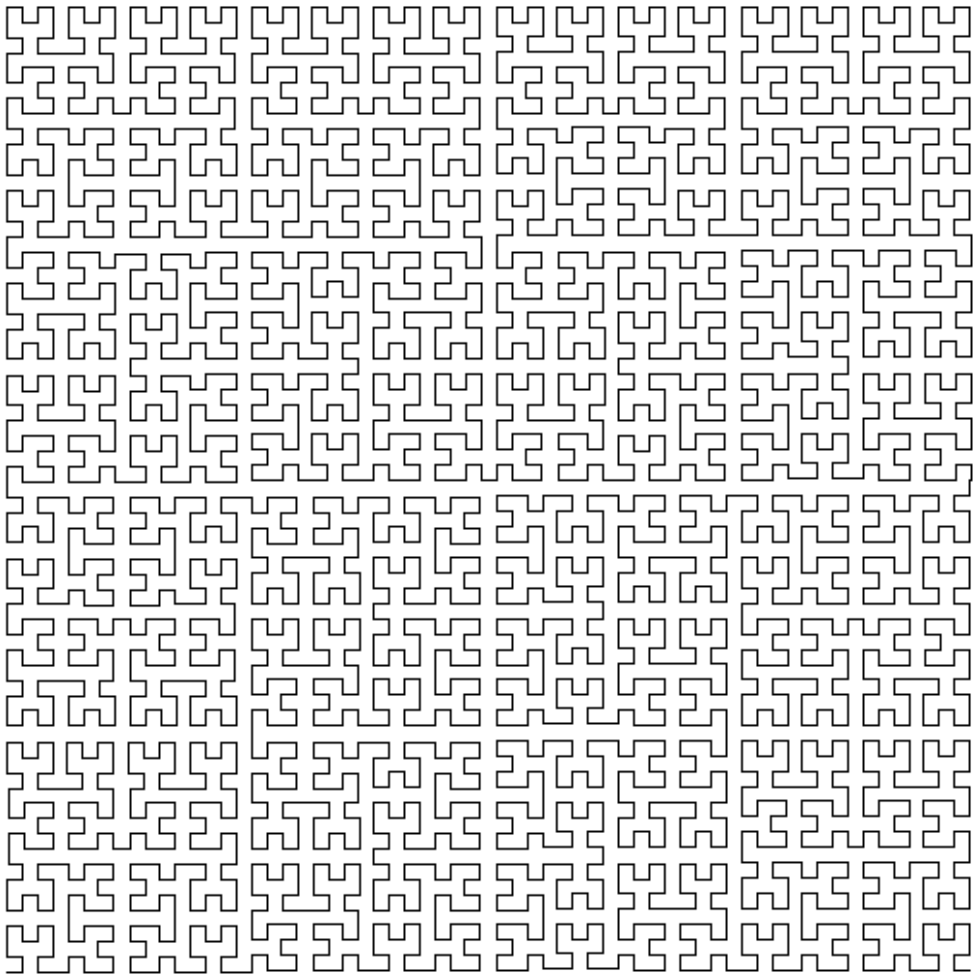
1st iteration

2nd iteration



3rd iteration

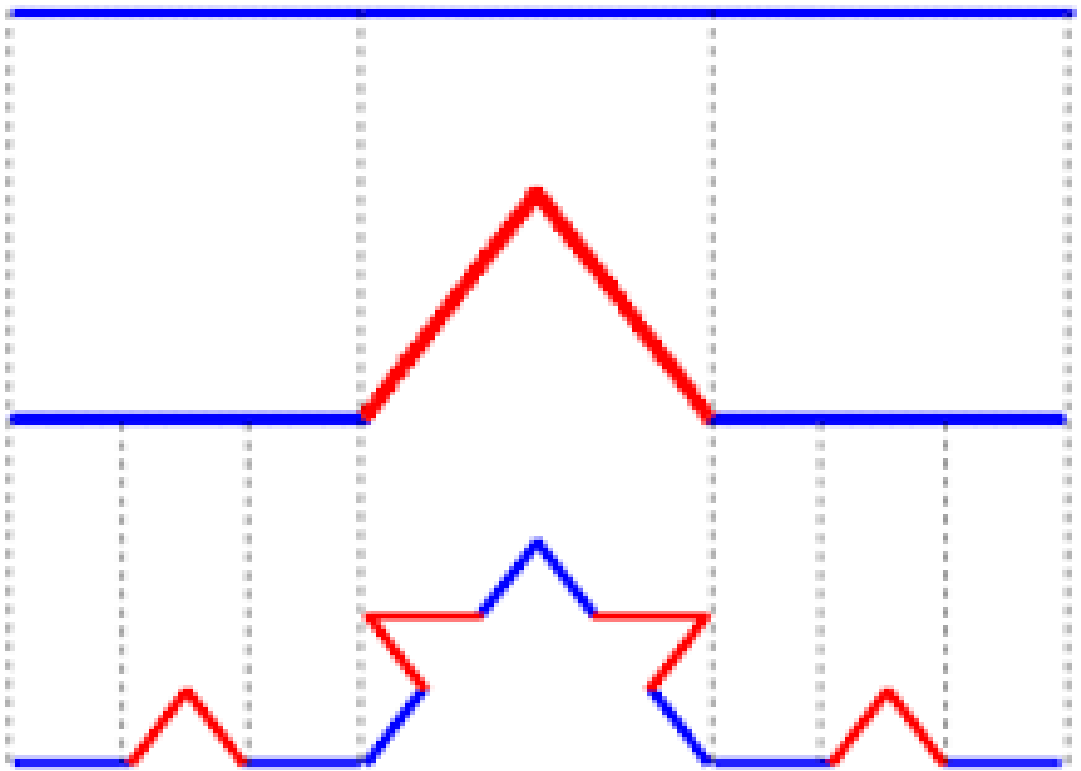
The Hilbert curve: geometric generation

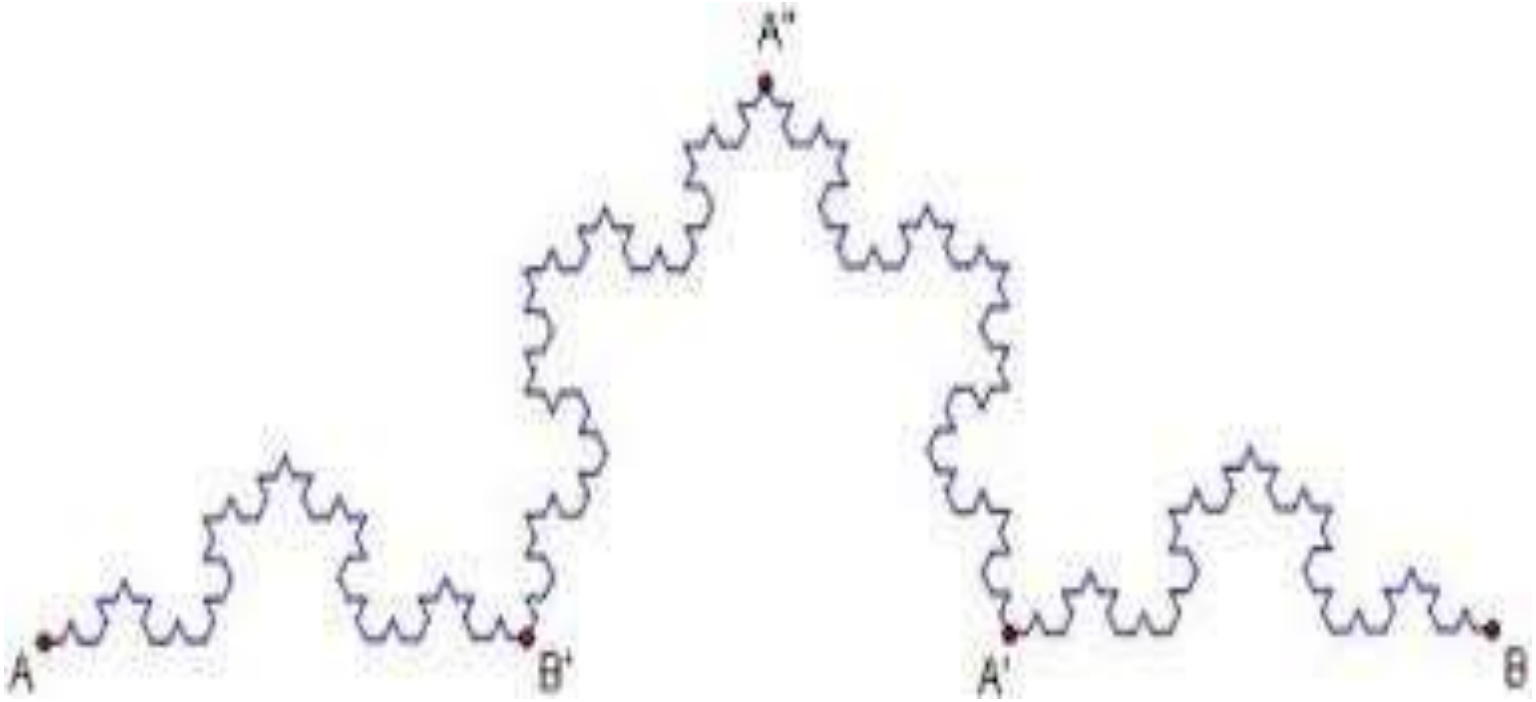


6th iteration

Koch Curve

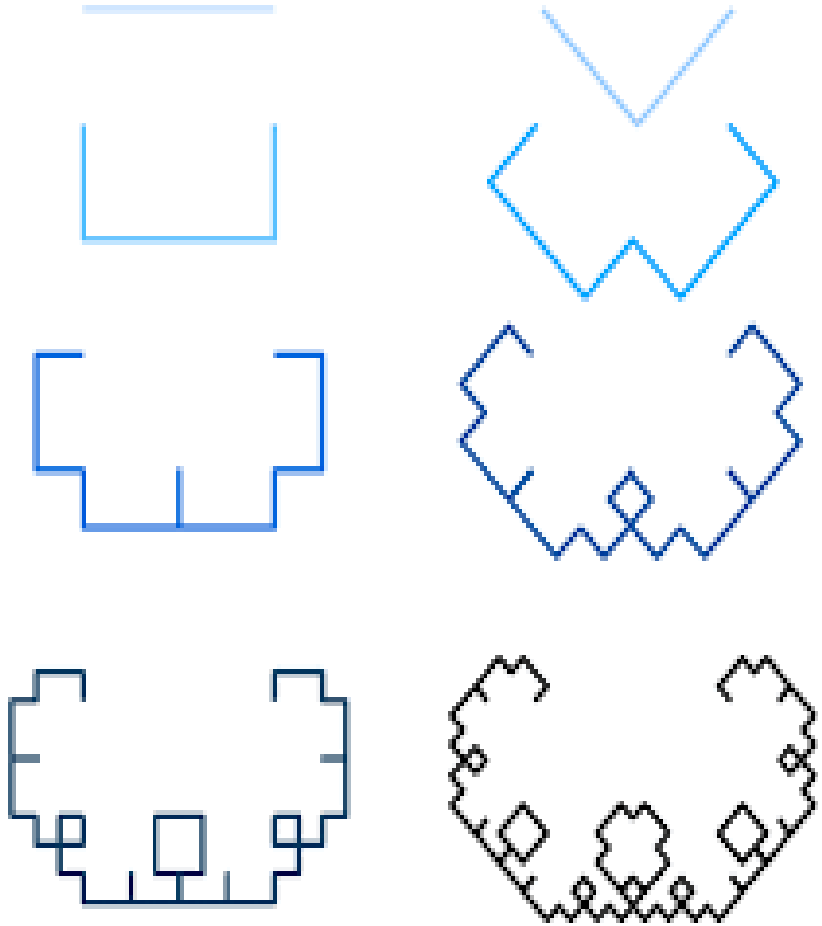
- Developed by Helga von Koch in 1904

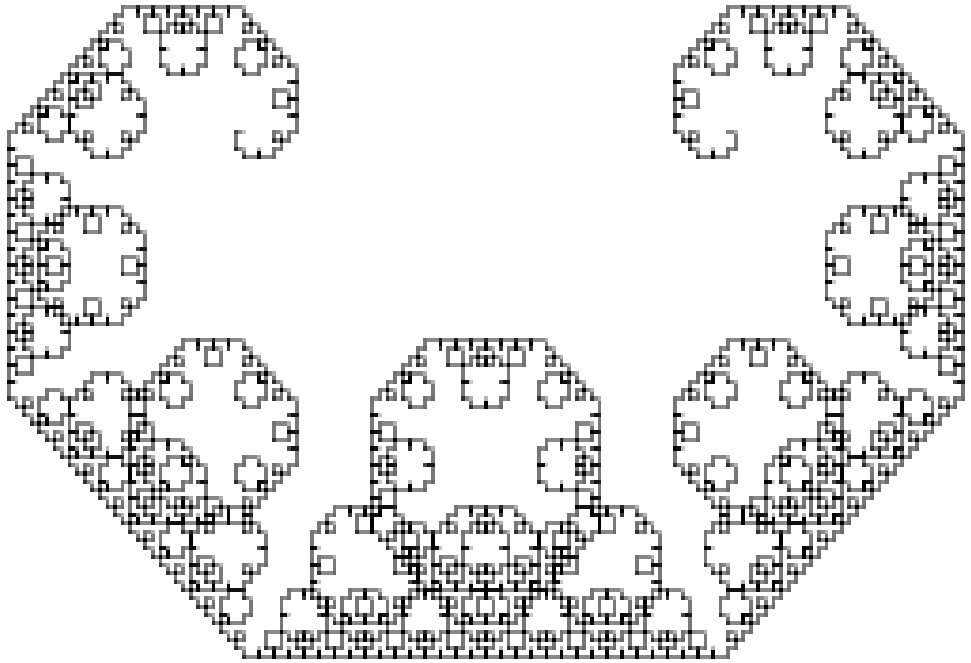



A''
A
B'
A'
B

C Curves

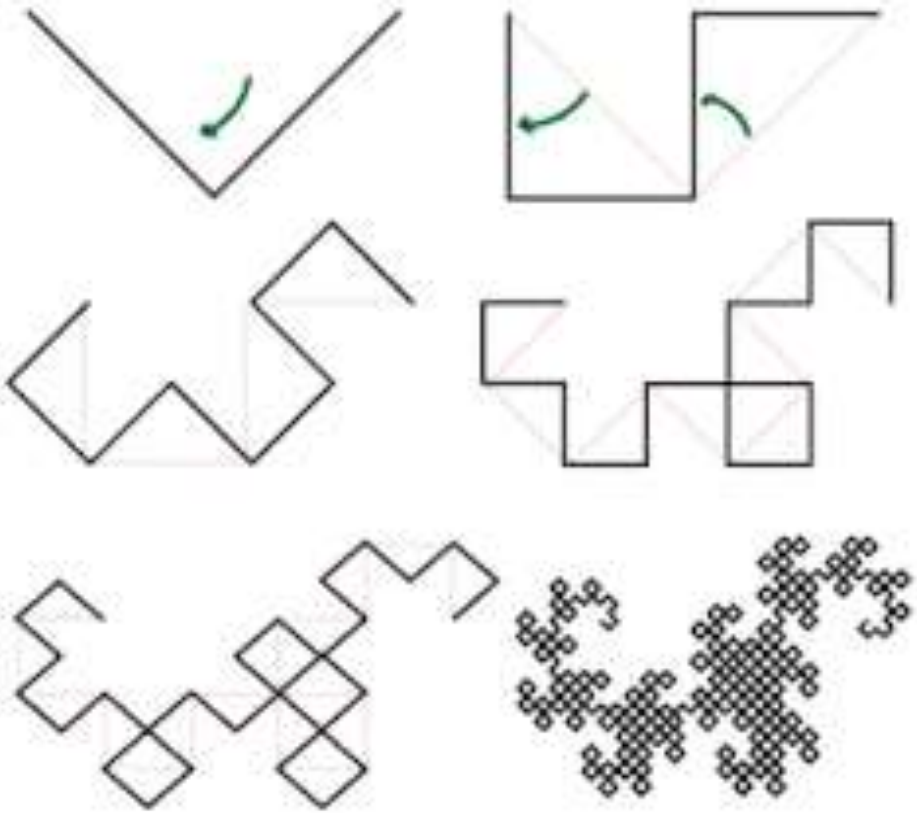
- Self similar fractals
- Described by Ernesto cesaro and Georg Faber in the year 1910

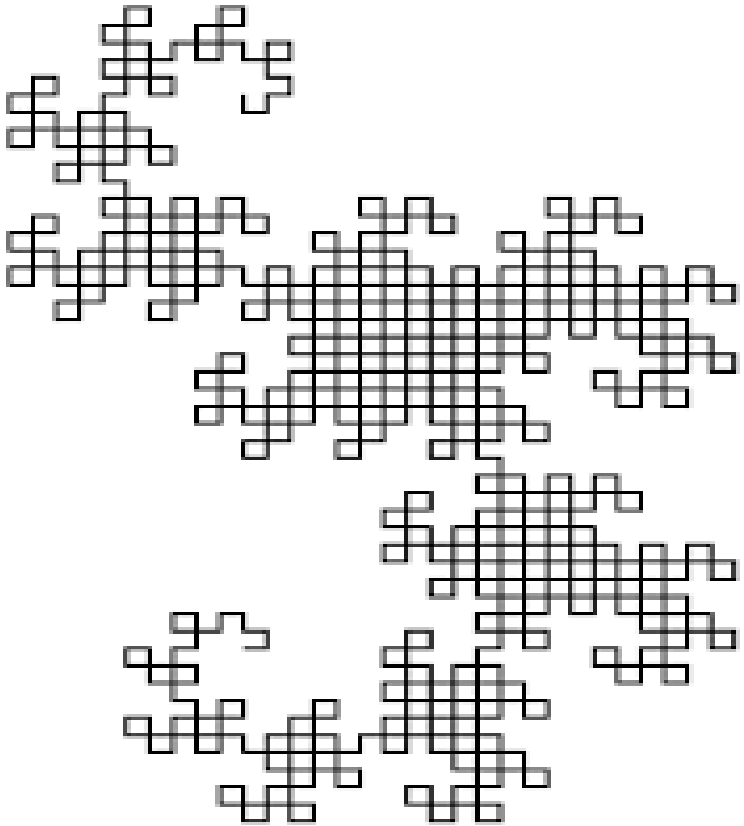




Dragon Curves

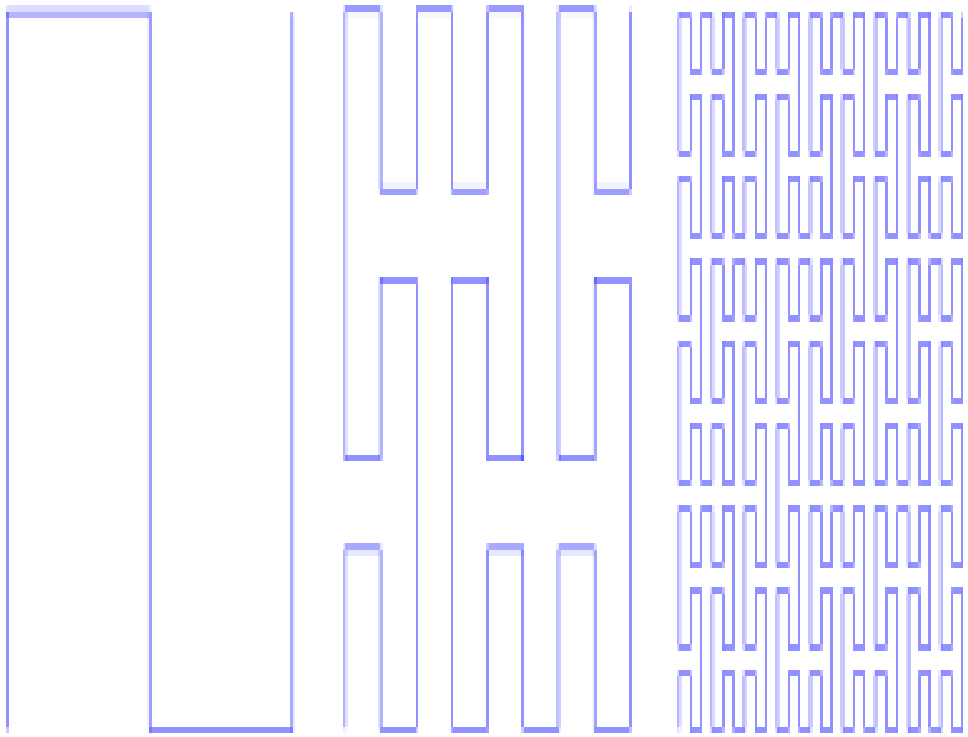
- Self similar fractal curves





Space filling curve/Peano curve

- Developed by Italian mathematician Guiseppe peano in 1890
- Space filling curve



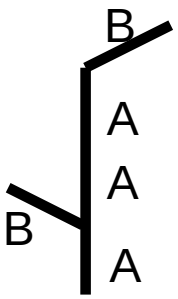
Grammar based models

- Structure defined by language
- Languages described by a collection of productions
- example, A->AA creates results of A, AA, AAAA,
- B->A[B] creates results of B, A[B], AA[B], etc.

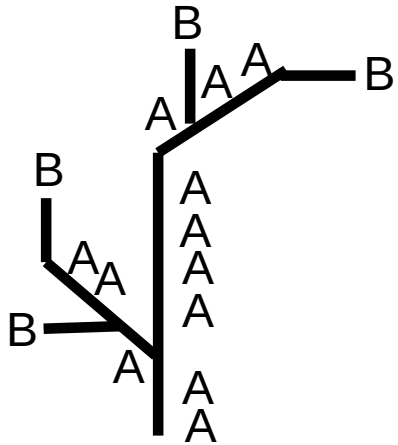
Advanced Modeling

Graftals

- Grammar based models…
  - [ ] for left branches
  - ( ) for right branches
  - A -> AA and B -> A[B]AA(B)
  - create a 2nd generation of:
    AA[A[B]AA(B)]AAAA(A[B]AA(B))



First Generation



Second Generation

Advanced Modeling

Graftals

- Grammar based models…
  - …use biological productions to simulate plants in development
  - …describe the topology of plants
  - …also describe the shape including the directions of branches and the arrangement of leaves

Advanced Modeling

- To simulate the growth of plants using languages include information on...
  - ...the current age
  - ...the growth rate of each segment
  - ...the probabilities of death, dormancy, growth
  - ...the shape (depending on type and age)
  - ...the branch angles (depending on type and age)
  - ...the color and texture of each segment

Advanced Modeling

Graftals

- Pseudo code simulates the growth of plants using graftals:
  - For (each moment in time)
    - For (each bud that is still alive)
    - Determine whether the bud dies, is dormant, or grow
    - If (the bud does not die)
    - If (the bud is not dormant)
    - Create a portion of a stem, determining its direction, position, color, texture;

    Create a new bud;

Advanced Modeling

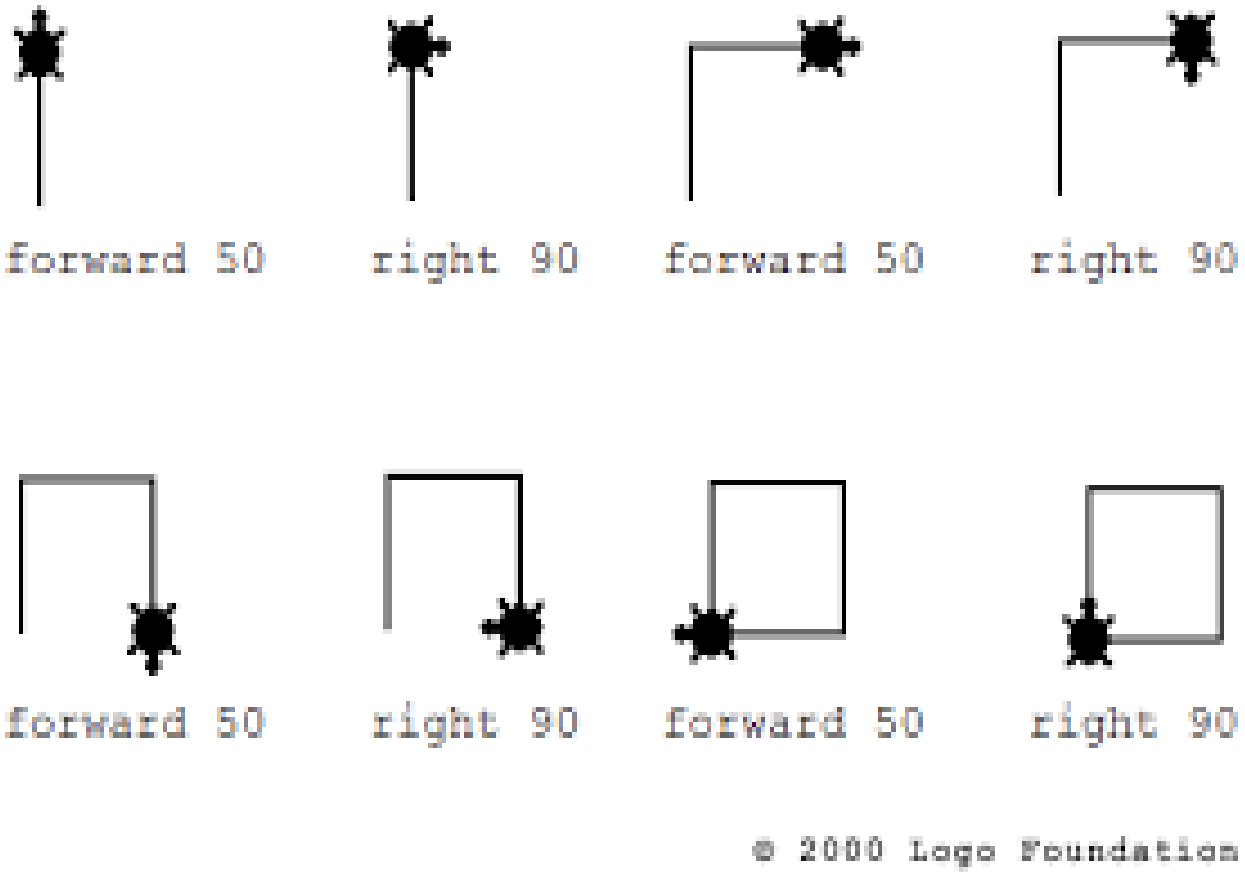
Particle Systems

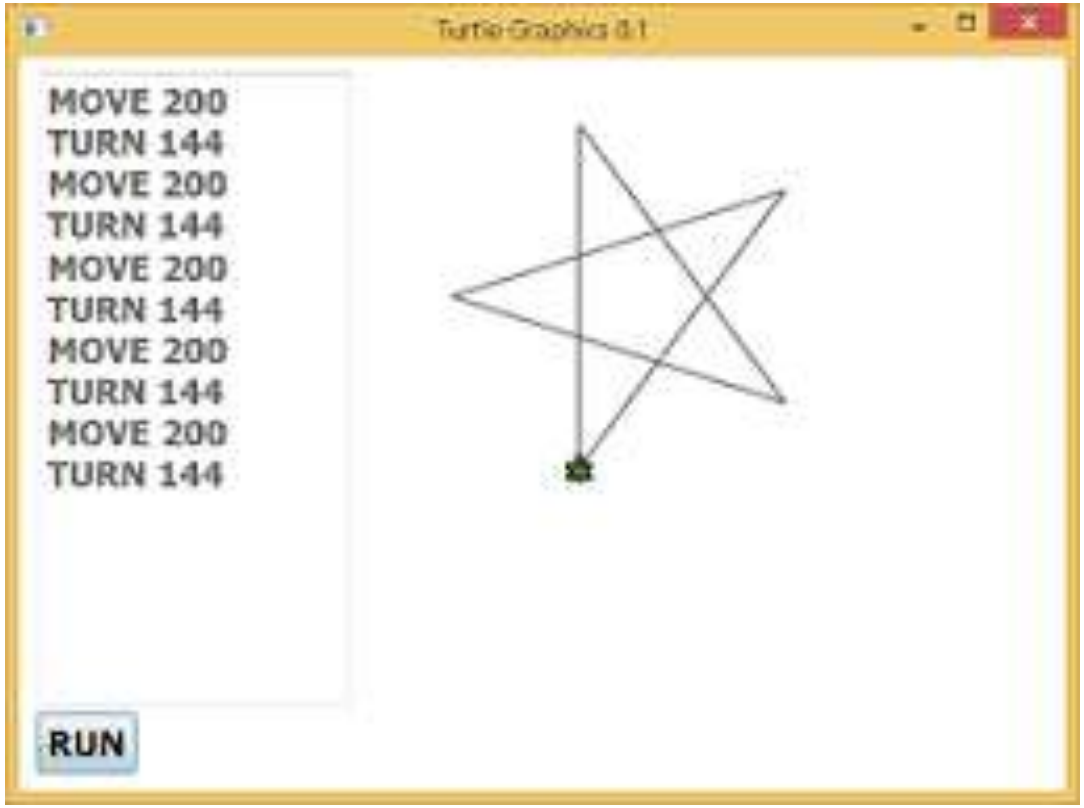
- Particle systems…
  - …can be used to simulate fire, clouds, water, fog, smoke, fireworks, trees, and grass
  - …are particularly useful for animating objects instead of just simulating static objects


Hindi
Spanish
English
INDO-
EUROPEAN
OLD WORLD
LANGUAGE FAMILIES

Turtle Graphics

- Logo programming language
- Developed by feurzig & seymour papert in 1966
- Popular graphics language for kids

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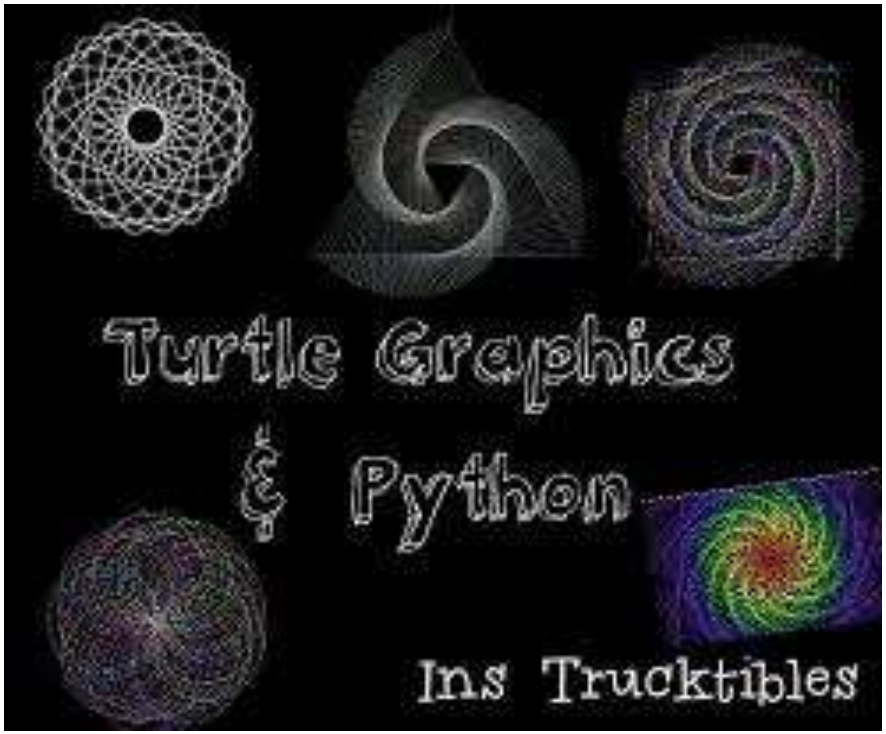
MOVE 200
TURN 144
MOVE 200
TURN 144
MOVE 200
TURN 144
MOVE 200
TURN 144
MOVE 200
TURN 144
RUN


Turtle Graphics
& Python
Ins Trucktibles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