

CS 111 Project 5: 3D Fractals

Due Monday, December 12, at 10:30 (at the beginning of the final)

Fractals are generated figures which can be highly complex, but are created using algorithms which are somewhat simplistic. For this project, write a program that uses vpython to generate a Pyramid fractal.

The Pyramid Fractal

Before beginning, I recommend reading chapters 12 and 13 of the book, as a review of recursion.

The pyramid fractal is produced by subdividing a pyramid into 5 smaller pyramids, and then subdividing each smaller pyramid, continuing until a depth limit is reached. This is a recursive fractal. That is, a fractal generated using an algorithm which includes itself as a potential step.

In general, your program will look something like this:

Set up initial pyramid

```
def subdivide(big_pyramid, subdivisions_remaining)
    if subdivisions_remaining < 1:
        draw big_pyramid
    Create 5 small pyramids based on big_pyramid
    for each small pyramid:
        subdivide(the small pyramid, subdivisions_remaining - 1)

subdivide(initial pyramid, number of subdivisions)
```

Obviously the above is not correct Python code, and some of the steps require some elaboration. A pyramid consists of 5 points: A top, and four lower corners. To draw a pyramid, draw lines along each edge. Look at the `curve` object in vpython for line drawing. To find a point midway between two other points (for example, between the top point and one of the lower corners) average each of the three values that describes the point. You may find it convenient to create a point class. Alternatively, there is a vector class provided with vpython which supports vector operations. It is also possible to represent points as a simple list of three items - x, y, and z coordinate. Any of these three methods will work, and it is up to you to choose between them.

The number of subdivisions will be limited by your computer's capacity, but 3 or 4 should be within the capacity of most modern laptops. High-end gaming computers may handle many more than this.

Grading

Your program must have an easy way to change the number of subdivisions, and it must support as many subdivisions as available processing power will support.

