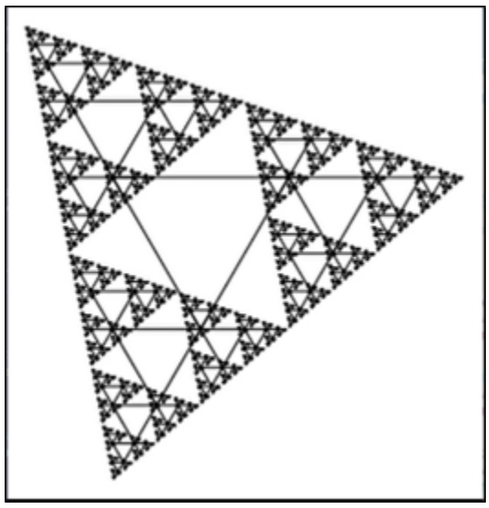
PS2: Recursive Graphics (Triangle Fractal)

Due: Thursday, May 26, 11:59pm

In this assignment, you will write a program that plots a triangle fractal as illustrated below.



It is a variation of the *Sierpinski triangle*. The Polish mathematician Wacław Sierpiński described the pattern in 1915, but it has appeared in Italian art since the 13th century.

1 Details

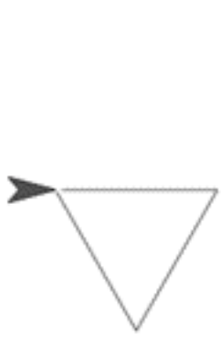
Your task it to write a program `TFractal.cpp` with a *recursive* function `fTree()` and a `main()` program that calls the recursive function.

Your program shall take two command-line arguments L and N (in that order):

- L The length of the side of the base equilateral triangle (`double`)
- N The depth of the recursion (`int`)

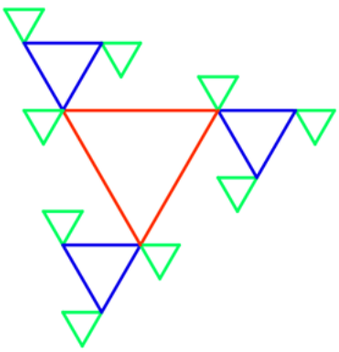
You should implement a class `Triangle` that derives from `sf::Drawable` (or one of its subclasses). You can then have each `Triangle` draw itself to your main window.

You should create an SFML window that is sized appropriately for your final image. A large value for L should not cause the image to spill over the boundary of your window and a small value should not cause most of the window to be empty space.

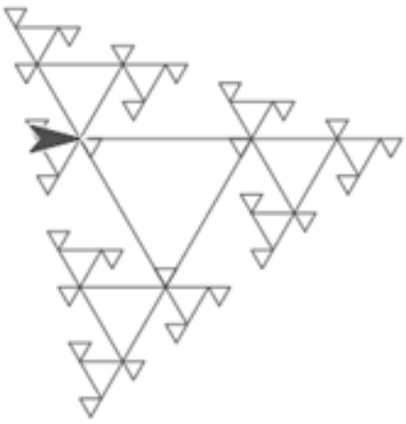


Base triangle

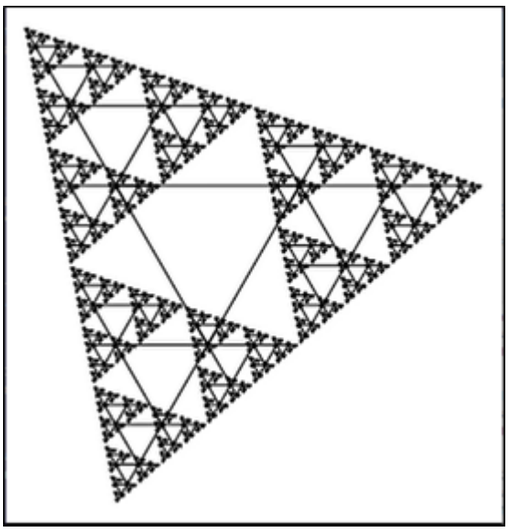
Iteration 1



Iteration 2



Iteration 3



Final Image

2 Linting

Google's style guide is available at `https://google.github.io/styleguide/cppguide.html`.

You should have installed Python and the `cpplint` during ps0. If not, go back and do so now. `cpplint` is a Python program for linting (checking the style) of C++ programs.

You can lint your program by running

```
cpplint --filter=-runtime/references,-build/header_guard,-build/c++11 --
   extensions=cpp,hpp
```

This will lint all `.cpp` and `.hpp` files in the current directory. We drop three filters. `-runtime/references` removes a check about when to use references and pointers as parameters. However, SFML does not follow the style for some of their functions, including the `Drawable::draw()` method. `-build/header_guard` removes a name check on your `#include` guards which it is often too specific with and doesn't play well with your submissions. `-build/c++11` removes checks for certain libraries added in C++11 that Google doesn't use in preference of their own libraries.

You should add a target called `lint` to your makefile and make sure that your program has no linting problems. You must do this for all future assignments.

3 Extra Credit

You can earn extra credit by making use of multiple colors in your tree. You can also add other reasonable features, such as animation. If you do any of the extra credit work, make sure to describe exactly what you did in `Readme-ps2.md`.

4 What to turn in

Your makefile should build a program named `TFractal` which takes two command line arguments L and N (in that order).

Submit a tarball to Blackboard containing:

- Your `TFractal.cpp`
- Your `Triangle.cpp` and `Triangle.hpp`.
- The makefile for your project. The makefile should have targets `all`, `TFractal`, `lint` and `clean`. Make sure that all prerequisites are correct.
- Your `Readme-ps2.md` that includes

1. Your name
2. Statement of functionality of your program (e.g. fully works, partial functionality, extra credit)
3. Any other notes

- Any other source files that you created.
- A screenshot of program output

Make sure that all of your files are in a directory named `ps2` before archiving it and that there are no `.o` or other compiled files in it.

5 Grading rubric

Feature	Points	Comment
Core Implementation	9	Full & Correct Implementation
	2	Draws the base triangle
	2	Draws multiple levels of triangles
	2	Number and size of triangles matches expected parameters
	1	Uses equilateral triangles
	1	Has proper orientation
	1	Sizes window to fit image
	-2	Non-recursive implementation
Makefile	1	
	1	Has targets `TFractal`, `lint`, `all`, and `clean`
Screenshot	1	
Readme	1	Complete
Lint	1	No lint problems
Extra Credit	2	
	+1	Uses multiple colors in the tree
	+1	Other reasonable features that are documented in the readme
Penalties		
	-1	Submission includes `.o` files
	-1	Submission not in a directory named `ps2`
	-10%	Each day late
Total	13	