Exercise List 2: Color Model /Scanline Fill Algorithm

MO814A/MC937A - Topics in Computer Graphics

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Deadline: 12/04 - 11:59pm
Send by google-classroom.

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1 Color Converter

There are many models to represent colors, whose choice depends on the application. For instance, RGB is commonly used to display colors on a computer monitor, while CMYK for printing out colors on paper.

In this first activity, you will have to implement a color converter tool for RGB (sRGB), CMYK, HSV and CIELAB (under Illuminant d50 = [0.9642, 1.0000, 0.8251]). **The conversion will be from any model to any other model.** The tool can be developed in C++ or Python. You are forbidden from using any conversion module or library in this assignment.

The invariants for this assignment are as follows: All attributes of RGB must be integers, and in the range 0 to 255, inclusive. All attributes of CMY must be floats, and in the range 0.0 to 100.0, inclusive. The hue attribute of HSV must be a float in the range 0.0 to 360.0, not including 360.0. The saturation and value attributes of HSV must all be floats, and in the range 0.0 to 1.0, inclusive. All attributes of CIELAB must be floats.

The program should read from the command line the desired color model and the input values and it must return the respective color triplets asked, example input and output:
In Python:
$ python program_name.py rgb hsv 255 255 255
In C++:
$ ./program_name rgb hsv 255 255 255
Output:
$ RGB to HSV 0.0 0.0 1.0

Accepted color model names: rgb, hsv, cmy, xyz, and cielab. Case sensitive.

Besides the compilable project, you will have to prepare a report containing:

1. Name, RA, and student email.
2. A brief description of how to use the application.
3. Operating system used for testing (Windows / Linux).

And the following questions:

1. Thinking about color systems, we know that the most used in the computing community is RGB. Explain the reasons for this
2. How is the equivalence given between the RGB and CMY models?

3. How would you define, in RGB, CMY and HSV:
    - A pure red color
    - A lilac color
    - Yellow
    - Brown
4. What is color? How is a color characterized?
5. What is the difference between an additive and a subtractive space? Explain the application of both (where they are used).
6. What is D50 white point used for?

2 Scanline Fill Algorithm

Objective: Implementation of the Polygon Fill algorithm (ScanLine base) The Polygon Fill algorithm (base of the ScanLine algorithm) performs the rasterization of a polygon, that is, given the description of the polygon (ordered sequence of vertices) it defines which points on the screen belong to it.

For this project, we want a graphic application that allows:

1. Creation of the polygon through a sequence of clicks (ordered vertices).
2. Rasterization (drawing on the application) of the polygon
    - The ScanLine algorithm must be contained in a single method.
    - The data structures for ET and AET must be easily recognizable.
3. Modification of the polygon
    - Fill color.
    - Position of vertices.
4. Updating the screen by deleting the current polygon and allowing the definition of a new one.

It must be implement in C++14 or superior using the Qt framework. A small QT example can be found in `https://github.com/aurea-soriano/PolygonPainter`.

Besides the compilable project, you will have to prepare a report containing:

1. Name, RA, and student email.
2. A brief description of how to use the application (Step by step of building a polygon).
3. Screenshots of at least one polygon with auto intersection and one without.
4. Justification of the data structures used (Class diagram containing the main classes, as support for the explanation)
5. Operating system used for testing (Windows/MAC/Linux).

Help:Links

- http://www.brucelindbloom.com/index.html?Calc.html
- http://colorizer.org/
- https://docs.google.com/presentation/d/1zDppd6Ywvethw4QL_Vzv2okwyfbeHGT_pujA1UZ2_vo/edit?usp=sharing

If you do not know where to start, or if you are completely lost, please contact me immediately.