CSE 628 Computer Graphics Project1
September 14 (Thur) 2023
100 points

Due: September 30 (Saturday) midnight (Submit your project report and Jupyter notebook to the Blackboard.)

Report Guidelines (No-compliance or late report will be penalized)

[1] Submit your project report in the pdf document format.

[2] Begin your report with a "title page" (including project number, your name, and the date submitted of your report).

[3] Name your report like this `<your-last-name>_<initial>_HW1.pdf`

[4] All work should be your own writing with clear references of your external sources.

[5] Do not share your report with other students. Any identical or nearly similar reports will get no credit.

[6] If you have any output or results (e.g., screenshots) that need to be submitted then these must be imbedded in your report.

[7] Show your Julia work for the assignments in a Jupyter notebook, called `HW1.ipynb`, and submit the notebook along with your project report to the Blackboard.

Reading PowerPoints: `01_Images and Colors`

Julia Notebooks

```
Images and Colors.ipynb
Color_Schemes.ipynb
```

Windows Application

LSystem

Assignments

1 For this problem, you need the following Julia packages:

```
Colors
Images
FileIO
FixedPointNumbers
Plots
```

1.1(20 points) Write a Julia function to filter an RGB color by a given color. The function has the following signature

```
filter_RGB(rgb:RGB{N0f8}, <filter_color_spec>)
```

where `<filter_color_spec>)` can be specified by one of the three ways:

- rgb values (for example, 0.5, 0.65, 0.1)
- hsv values (for example, 60, 1, 0.8)
- color name string (for example, “gold”, say using `Colors.color_names["gold"]`)

Test your function on the image files, `VanGogh.jpg` and `barbara_color.png`.

List your function and include test screenshots in your project report.

1.2(15 points) Implement a Julia program to convert a gray image to a (pseudo) color image. Test your program on the given gray image files, `cameraman_gray.png`. and `lena_gray.png`. List and explain your program and show the original and converted images in your project report.

2 For this problem, you need the following Julia packages:

```
Colors
ColorSchemes
colorSchemeTools
Images
FileIO
FixedPointNumbers
Plots (or GLMakie)
```

Study the notebook, `Color_Schemes.ipynb`, to learn how to use color schemes (or color maps) in various applications and manipulate color schemes. The paper, "Good Colour Maps: How to Design Them" (https://arxiv.org/abs/1509.03700) is a good resource of what are color maps and guidelines for using them for data visualizations.

2.1 (5 points) Run the following Julia script (using the `ColorSchemes` package)

```
colorschemes[:vangoh].notes
```

to discover how the color scheme, `vangoh`, was made.

2.2(15 points) Use the `extract` function of the package, `ColorSchemeTools`, on the painting (find a image file for it) mentioned in the notes of 2.1 to get a color scheme out of the painting. Then compare the similarity of the color scheme with the `ColorSchemes`' `vangoh` color scheme. Explain your similarity measurement and discuss the result in your project report.

To learn how to use the `extract` function, consult this page:

https://juliagraphics.github.io/ColorSchemeTools.jl/latest/tools/#Extracting-colorschemes-from-images

2.3 (15 points) Use the function `mandelbrot(x, y)` given in `Color_Schemes.ipynb` to compute the Mandelbrot set in a range of your choice (try to find a range with lots of variations in the Mandelbrot set). Then display the range of the Mandelbrot set using the `heatmap` function (either from `Plots` or `GLMakie`) with three different color schemes. The goal is to make the displays beautiful.

List your Julia script and include screenshots of the displays in your project report.

3 The Windows application, `LSystem.exe`, which you can download from the Blackboard allows you to draw fractal curves based on models defined by L-systems.

3.1(20 points) Create a new model that generates interesting fractal curves. List the L-system which defines the model and include a screenshot of the L System Model Data and a screenshot of the generated fractal curve.

3.2(10 points) Explain how the turtle graphics works and the supported commands in this application. Suggest two commands that can be used to enhance the drawing graphics. (Note: the Julia 2D drawing package, `Luxor`, also supports turtle graphics.)