Lab 1

DH2323 DGI22

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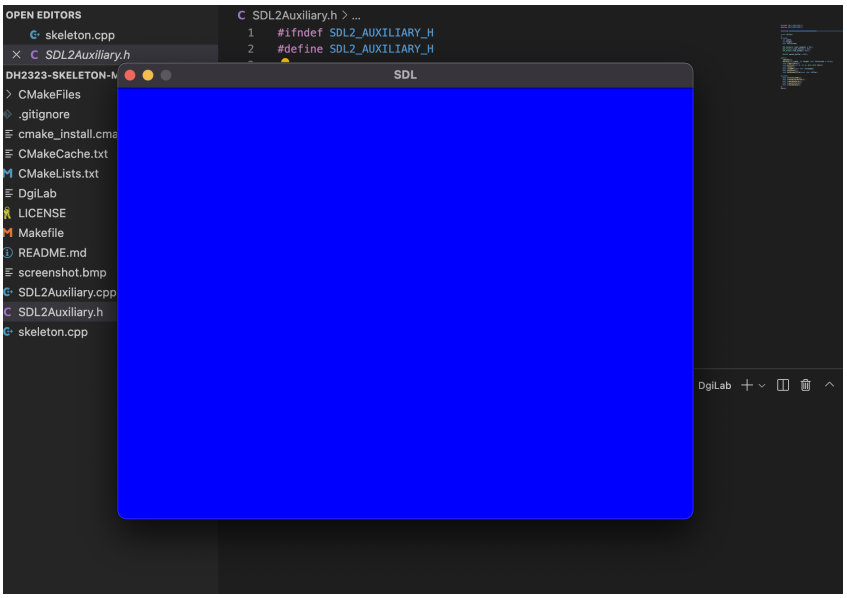
1. Set up

I cloned the github skeleton code from user Lemonad[1].



2. Intro to 2D graphics

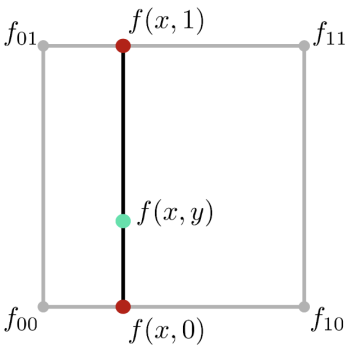
2.2 Linear interpolation

Linear interpolation is in short averaging the two values that surround the new value. It can be done in different directions, e.g linear in x or linear in y. Formula is f(t) = (1-t)a + tb, with t being between 0 and 1.

2.3 Bilinear interpolation

Bilinear interpolation is pretty much the same as linear interpolation, only that you first have to interpolate twice in either y direction or x direction, and then interpolate once in the other direction. In this implementation, I will first interpolate the sides that have constant x values and varying y values, and then use these sides to interpolate the "middle line" where x will vary.

2D, "bi-linear"



$$f(x,y) = (1-x)(1-y)f_{00} + x(1-y)f_{10} + (1-x)y f_{01} + x y f_{11}$$

$$= (1-y)((1-x)f_{00} + x f_{10}) + y((1-x)f_{01} + x f_{11})$$

"interpolate twice in x direction and then once in y direction"

This is from the lecture slides of DH2320/DD2258 VT22-1 Introduction to Visualization and Computer Graphics

[1] https://github.com/lemonad/DH2323-Skeleton

Results from 31/3-2022

3. Starfield

To achieve the starfield, I researched some things to better understand the problem statement. On a personal blog, I found a good introduction to perspective projection and how to make a 3D starfield[2]. Apart from finding good information online, I found the instructions to be very clear and easy to follow.

I needed to find how to produce a random float number with a range between negative and positive. I found a helpful article on Stack Overflow[3].

"A good value for it is f=H/2. Then the vertical field of view for the camera will be 90 degrees. What is the resulting horizontal field of view? Try to calculate this."

I had to research focal length and field of view for this[4]. The focal view is set to f = h/2. The shorter the focal length, the wider the angle of view. The vertical field of view for the camera is 90 degrees. The formula for it is given by $fov_v = 2 \times arctan((h/2) \times f)$. Thus, the formula for the horizontal field of view is given by $fov_h = 2 \times arctan((w/2) \times f)$. The horizontal field of view is then 106 degrees.

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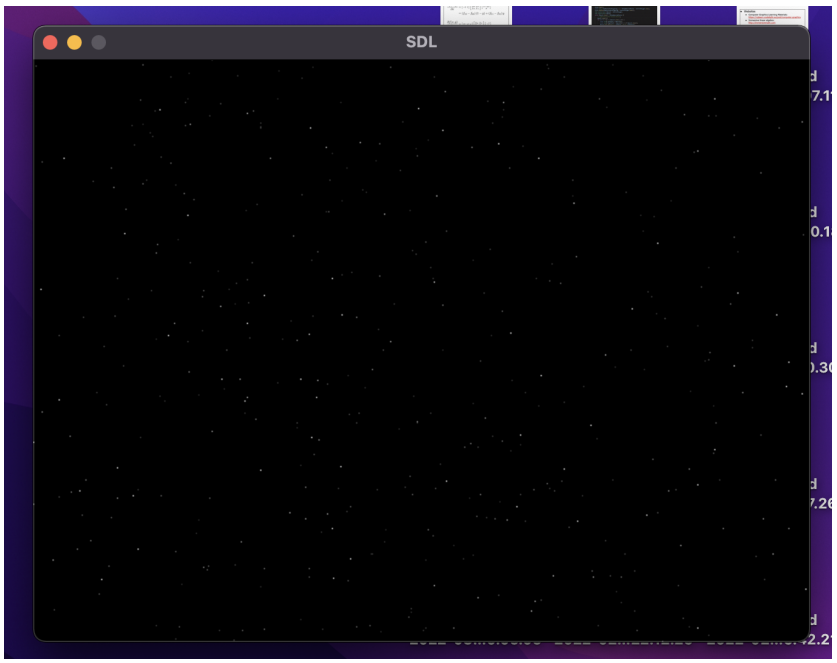
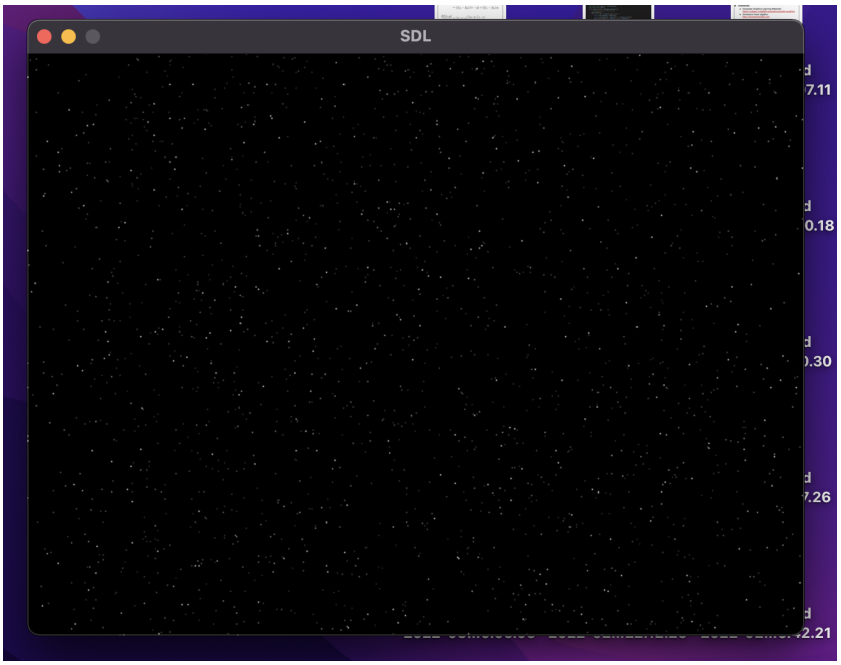
[2] https://www.j0e.io/tutorials/starfield/

[3] https://stackoverflow.com/questions/4310277/producing-random-float-from-negative-to-positive-range

[4] https://www.pcgamingwiki.com/wiki/Glossary:Field_of_view_(FOV)



A thousand stars, from 31/3-2022



Five thousand stars, it looks nicer with more of them. From 31/3-2022

I tried the starfield with different velocities.: 0.0001f looks smooth and nice, 0.001f looks very fast, 0.01f cannot really see the motion.

I implemented the three equations in the lab instructions, which worked to get the stars moving. A movie of it is included in the lab1 folder.