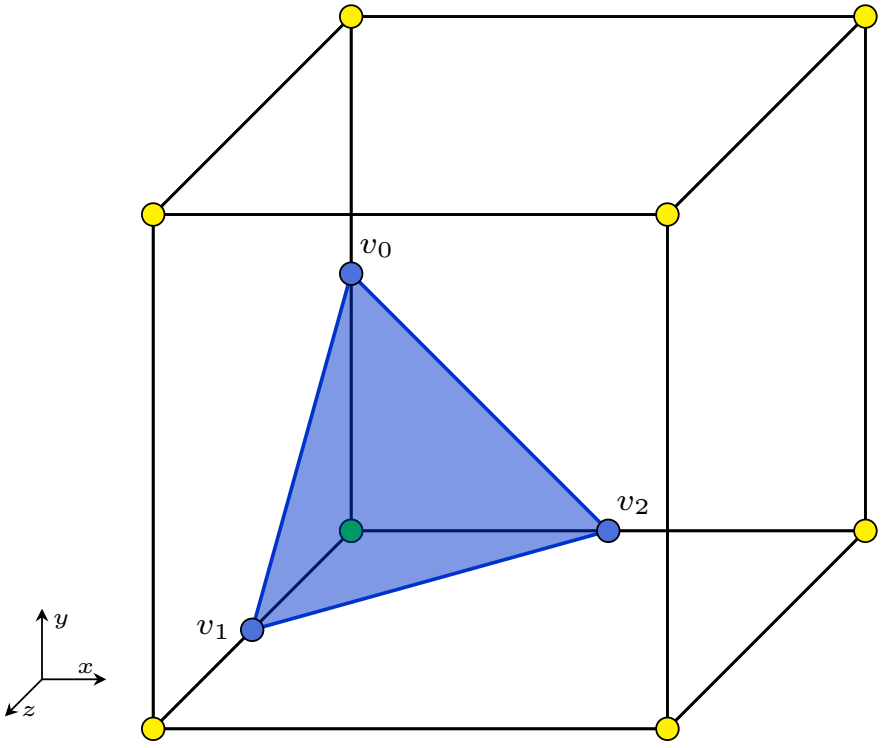
CS3388B, Winter 2023

Problem Set 8

Due: March 19, 2023

Exercise 1.

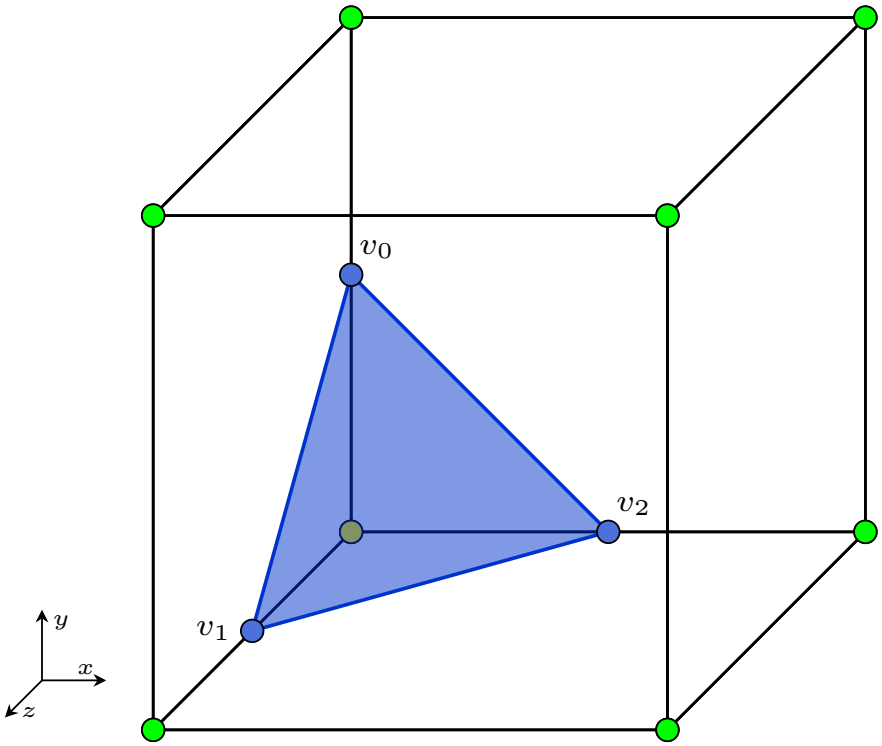
Let a triangle be defined by vertices v_0, v_1, v_2 as respective positions $(5, 5.5, 5)$, $(5, 5, 5.5)$, $(5.5, 5, 5)$. Assuming a counter-clockwise winding order, what is the normal of this triangle? The below figure shows this case as one which is possible from a running of marching cubes: the corner of the cube at $(5, 5, 5)$ is *inside* the object.



$\vec{n} = \left(\frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}\right)$

Exercise 2.

Consider the *inverse case* of that of exercise 1. Where now every corner of the cube is inside the object *except* the corner at $(5,5,5)$. What is the correct order of vertices to specify this triangle if we assume a counter-clockwise winding order? What is the normal of this triangle?



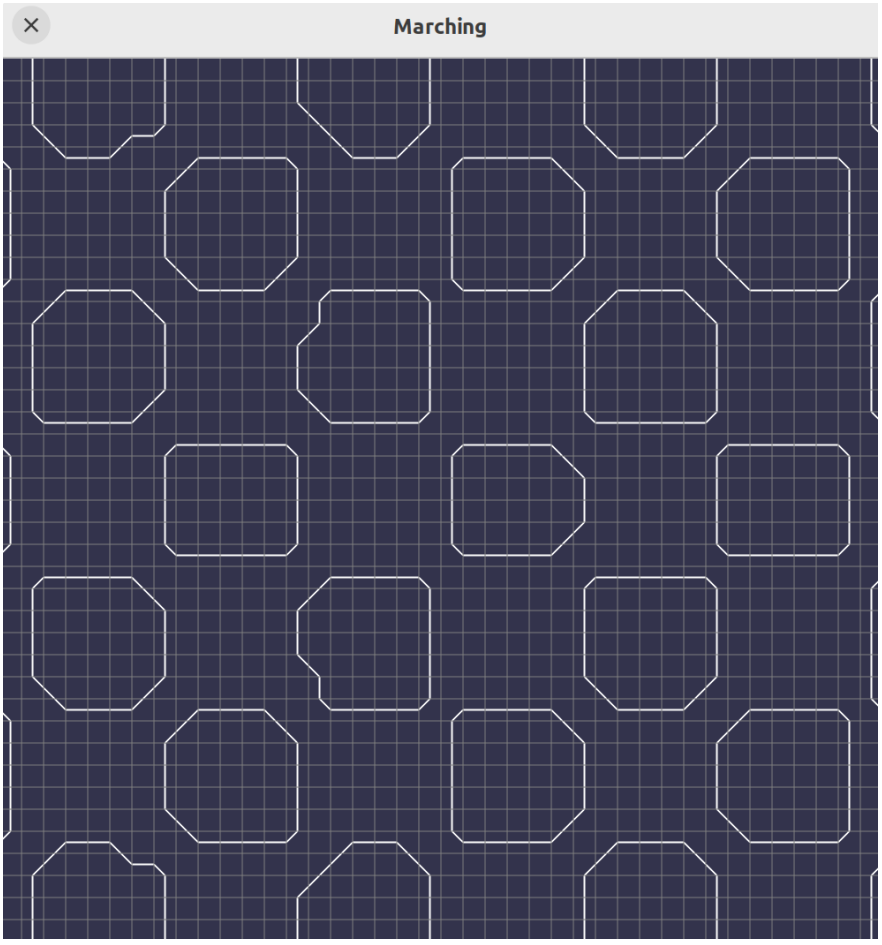
$\vec{n} = \left(\frac{-\sqrt{3}}{3}, \frac{-\sqrt{3}}{3}, \frac{-\sqrt{3}}{3}\right)$

Exercise 3.

Modify the marching squares program so as to *overlay* the grid of squares on top of the resulting line segments. Use the `MarchingSquares.cpp` file on OWL as your starting point.

Can you identify the individual cases of marching squares as they appear on your grid?

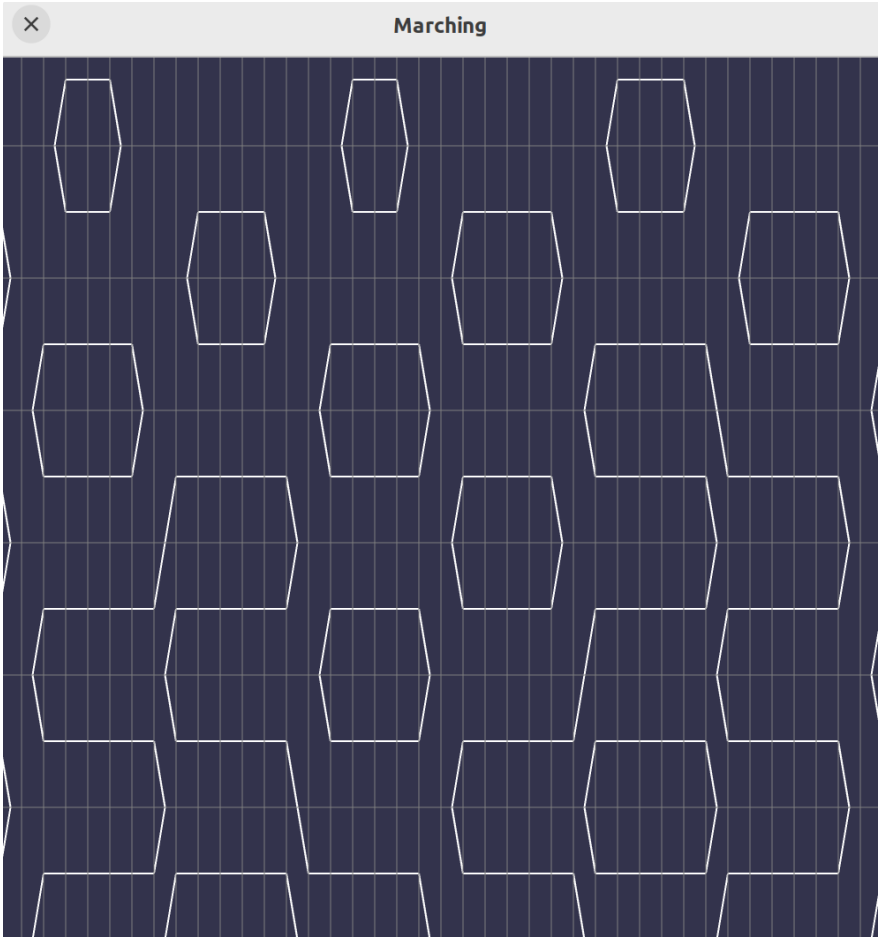
If done correctly, you'll get something like:



Exercise 4.

Modify your marching squares program from Exercise 3 to use a *marching rectangles* algorithm. That is, the step test regions should be rectangles instead of squares. Modify the source code so that it can receive the horizontal step size and the vertical step size as two different command-line arguments.

If done correctly, you'll get something like:



Submission.

Submit to OWL:

- Your answers and workings for Exercises 1 and 2.
- A screenshot of your program's output for Exercise 3.
- A screenshot of your program's output for Exercise 4.
- Your modified marching squares source code that satisfies both Exercise 3 and 4.