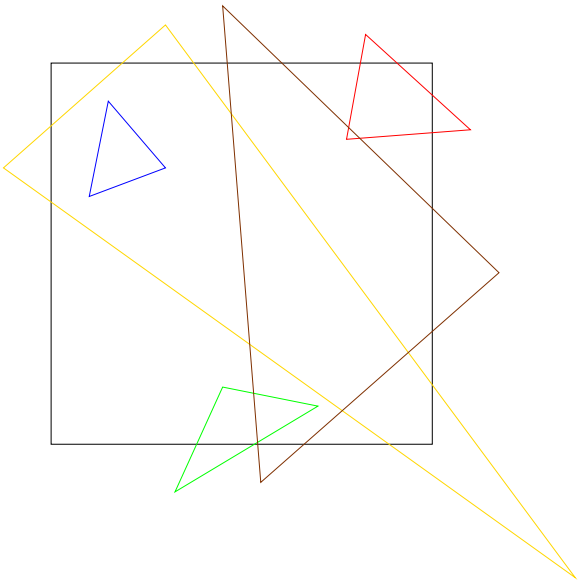
Test1: solutions

1 Problem 1

Yes. Here are examples:



2 Problem 2

Depth is linearly interpolated from vertices.

First, we compute the depth at $(3,4)$ for the first triangle. We find A, B, C such that

$$D(x,y) = Ax + By + C$$

satisfies

$$D(0,0) = C = .1, D(5,5) = 5A + 5B + C = .6, D(0,5) = 5B + C = .35$$

The equations give $C = .1$, $B = .05$ and $A = .05$ and thus depth at $(3,4)$ is

$$D(3,4) = .1 + .35 = .45.$$

For the second triangle, the equations are

$$D(5,0) = 5A + C = .2, D(10,0) = 10A + C = .7, D(0,10) = 10B + C = .7.$$

The solution is $A = .1$, $C = -.3$ and $B = .1$ and therefore the depth at $(3,4)$ is

$$D(3,4) = .7 - .3 = .4.$$

Therefore, it's less than the depth of the firsat triangle and so the second one will be visible at the pixel. It's going to be colored red.

3 Problem 3

1 and 6. If viewpoint is inside one of the spheres, then only 6 (then, something would be visible in any direction, so in case 1 the image wouldn't be black)

4 Problem 4

(a) Gouraud or Phong (b) Phong only (c) Flat

5 Problem 5

Here is how to obtain the symmetry. First, transform in such a way that the line goes into the x-axis. This can be done by translating by $[0, -1]$ and then rotating by -45 degrees.

Then, we apply symmetry about the x-axis and finally apply the inverses of the rotation and translation. Here is the result:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \sqrt{2}/2 & -\sqrt{2}/2 & 0 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \sqrt{2}/2 & \sqrt{2}/2 & 0 \\ -\sqrt{2}/2 & \sqrt{2}/2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$$