CS3388B, Winter 2023

Problem Set 2

Due: January 20, 2023

Exercise 1. Any RGBA32 color can be encoded as 4 byte unsigned integer. Give the binary number for the color `#8CE4FA`

10001100111001001111101011111111

Exercise 2. How many colors are possible in the RGB16 color space?

Consider a hypothetical color space with 4 color channels CMKY, where C is encoded using 6 bits, M encoded with 10 bits, Y encoded with 12 bits, and K encoded with 4 bits. How many colors are possible in this color space?

15 bits of information: $2^{15} = 32768$

2^6 choices for C, 2^{10} choices for M, 2^{12} choices for Y, 2^4 choices for K. Thus $2^{32} = 4294967296$ possible colors.

Exercise 3. Consider the following code segment. How many triangles are drawn?

```
glBegin(GL_TRIANGLE_FAN);
glVertex2f(0., 0.5);
glVertex2f(0.2, 0.5);
glVertex2f(0.4, 0.5);
glVertex2f(0.6, 0.9);
glVertex2f(0.7, 0.2);
glVertex2f(0, -0.2);
glVertex2f(-0.2, 0.0);
glEnd();

glBegin(GL_TRIANGLES);
for (int i = 1; i < 10; ++i) {
    glVertex2f(0.09*i, -0.7);
    glVertex2f(-0.09*i, -0.3);
}
glEnd();
```

FAN: 5 tris
TRIS: 9*2 vertices -> 6 tris
TOTAL: 11

Exercise 4. Assume a clockwise winding order. Calculate the normalized normal vector for the triangle rendered by the following code segment, assuming that OpenGL uses a left-hand coordinate system where the x-axis extends to the right and the y-axis extends upward.

```
glBegin(GL_TRIANGLE_FAN);
glVertex2f(0.4, 0.4);
glVertex2f(-0.3, 0.2);
glVertex2f(0.2, -0.3);
glEnd();
```

You don't have to calculate anything! This triangle obviously lies in the X-Y plane. Therefore, it's vector is either $\hat{k}$ or $-\hat{k}$. We just have to work out the direction of the normal and the direction of coorindate system. Based on clockwise winding order, the normal of this triangle is pointing *away* from the viewer, and thus into the screen.

Now, we are in a left-handed coordinate system, thus $\hat{k}$ points *into* the screen. The normalized normal vector of this triangle is thus $\hat{k}$.