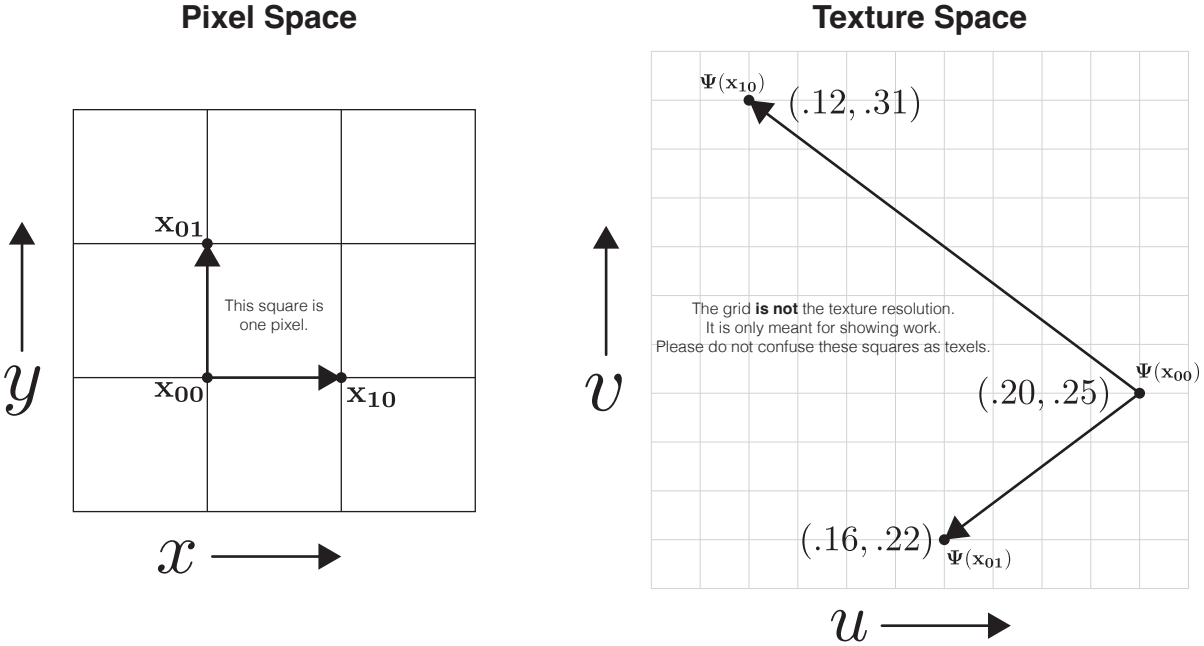


3. We are given pixel point $\mathbf{x}_{00} = (x, y)$, as well as \mathbf{x}_{01} and \mathbf{x}_{10} , each 1-pixel away from \mathbf{x}_{00} . These three points are mapped to their corresponding locations in texture space by the mapping $\Psi(\mathbf{x})$. Note that the mapping uses barycentric coordinates! The texel space is in the range $[0, 1]$. At what mipmap level, L , should we sample to retrieve the texture for point \mathbf{x}_{00} ?



4. For mipmap levels 0 through 5, the texture value at $\Psi(x_{00})$ is given by:

$$T_0 = 0.38, \quad T_1 = 0.42, \quad T_2 = 0.36, \quad T_3 = 0.40, \quad T_4 = 0.39, \quad T_5 = 0.37.$$

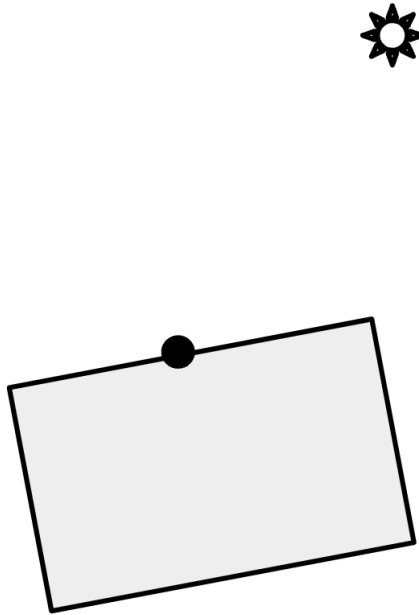
Given our answer to the previous question, what texture value should we use?

5. How can we combine values from two neighboring mipmap levels to get an even smoother result?

2 Graphics Pipeline — Lightning Round!

1. Name and describe the three terms in the Blinn-Phong Reflection Model.

2. A light source shines on a tilted surface. Draw the light direction vector, \mathbf{l} , and the normal vector, \mathbf{n} , at the given point.



3. What is the light per unit area on this surface proportional to, according to Lambert's cosine law?

4. Complete the following implementation of the Z-Buffer Algorithm in C++.

```
const int WIDTH = 800; // Width of framebuffer
const int HEIGHT = 600; // Height of framebuffer

struct Color {
    float r, g, b;
};

struct Sample {
    int x, y;
```

```

    float z;
    Color color;
};

struct Triangle {
    std::vector<Sample> samples;
};

void zBufferAlgorithm(const _____ triangles,
                    _____ framebuffer,
                    _____ zbuffer) {
    for (const Triangle& T : triangles) {
        for (const Sample& sample : T.samples) {
            int x = sample.x;
            int y = sample.y;
            float z = sample.z;

            if (x >= 0 && x < WIDTH && y >= 0 && y < HEIGHT) {
                if (_____ ) {
                    framebuffer[x][y] = sample.color;
                    _____;
                }
            }
        }
    }
}

```

5. Prior to running this algorithm, what should the Z-buffer values be initialized to?