CG assignment 7

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Ex 1 [7 points]

$$image\_size = 10 * 10$$

$$p1 = (-1, -1, 2)$$

$$p2 = (7, 1, 10)$$

Computing the intersection of p1 and p2 with the image plane, we get the below result:

$$q1 = \frac{p1}{p1_z} = (-0.5, -0.5)$$

$$q2 = \frac{p2}{p2_z} = (0.7, 0.1)$$

As we assume that the top-left corner has coordinates (1, 1) and the bottom-right one is at (10, 10), we need to q1 and q2 to image coordinates:

$$q1 = [(-0.5 + 1) * \frac{10}{2} + 1, (1 - (-0.5)) * \frac{10}{2} + 1] = [3.5, 8.5] \approx [3, 8]$$

$$q2 = [(0.7 + 1) * \frac{10}{2} + 1, (1 - 0.1) * \frac{10}{2} + 1] = [9.5, 5.5] \approx [9, 5]$$

Computing the midpoint decider:

```
def compute_midpoint():
    x1, y1 = 3, 8
    x2, y2 = 9, 5

    x, y = x1, y1

    dx = x2 - x1
    dy = abs(y2 - y1)

    f = -2 * dy + dx
    for _ in range(dx + 1):
        print(f"({x},{y})")
```

```
x += 1
if f < 0:
    y -= 1
    f += 2 * dx
f -= 2 * dy
```

This gives us the following values:
(3,8), (4,8), (5,7), (6,7), (7,6), (8,6), (9,5) So the middle value is: (6,7)
p_z can hence be calculated the following way:

$$p_z = \frac{1}{(1-\lambda) \cdot \frac{1}{p_{1z}} + \lambda \cdot \frac{1}{p_{2z}}}$$

as (6, 7) is exactly in the middle of the line between p1 and p2:

$$\lambda = \frac{1}{2}$$

Hence:

$$p_z = \frac{1}{(1-\frac{1}{2}) \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{10}} = \frac{10}{3} = 3.333$$

So z-value associated with the middle pixel (along the horizontal direction) of the line is 3.33 .

$$p1 = rgb(1, 0, 0)$$
$$p2 = rgb(0, 1, 0)$$

As the new point lies between p1 and p2, the rgb values of the new point will be:

$$\begin{aligned} rgb = (& \\ & 1 \cdot 0.5 + 0 * 0.5, \\ & 0 * 0.5 + 1 * 0.5, \\ & 0 \\ ) & \\ = (0.5, 0.5, 0) & \end{aligned}$$