Università
della
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Faculty
of Informatics

Computer Graphics (Fall 2022)

Assignment 7: Rasterization   November 3, 2022

Exercise 1 [7 points]

Let the camera opening angle be $\pi/2$ radians and the image be 10×10 pixels large. Which pixels does the midpoint algorithm described during the lecture (without anti-aliasing) set for the line from $p_1 = (-1, -1, 2)$ to $p_2 = (7, 1, 10)$, given in global coordinates? Assume that we index pixels starting from top-left corner, i.e., the top-left pixel has indices $(1, 1)$ and the bottom-right one $(10, 10)$.

- What is the z-value associated with the middle pixel (along the horizontal direction) of the line?

- Assuming that the p_1 should be rendered in red, $rgb = (1, 0, 0)$, and p_2 in green, $rgb = (0, 1, 0)$, what is the color of the middle pixel?

Provide calculations using perspective interpolation.

Exercise 2 [8 points]

During the lecture, we discussed a triangle rasterization algorithm which uses barycentric coordinates to determine whether the pixel center lies inside the rasterized triangle. One problem, which we discussed in the class, is that the computation of the barycentric coordinates from scratch for every pixel is expensive. Derive an incremental approach to solve this problem. More precisely, assuming that you know the barycentric coordinates of the pixel (x, y), derive the formula that updates these coordinates such that they are valid for pixels $(x + 1, y)$ and $(x, y + 1)$. Note that a similar trick we used to avoid unnecessary evaluations of the implicit line equation during line rasterization. Using your derivation, write a pseudo code of the whole triangle rasterization algorithm assuming that your input are three vertices in the global coordinate space given in the counter-clockwise order. You can assume that your algorithm should color the pixels whose centres lie inside the triangle, and there is no pixel centers lying exactly on one of the triangle edges.

Submission

Submit a single PDF including all the calculations you did do solve the assignments to iCorsi. You are allowed to use calculator.

Solutions must be returned on November 10, 2022 via iCorsi3