

CSE 167 (WI 2025) Exercise 6 — Due 2/21/2025

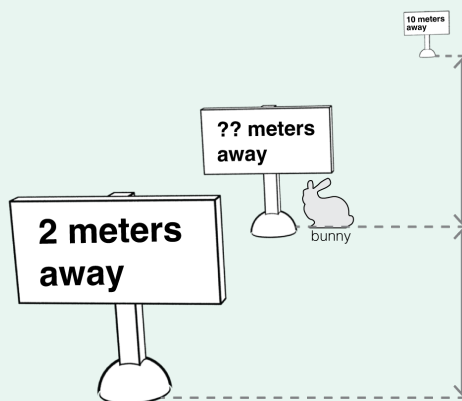
Exercise 6.1 — 3 pts. (Barycentric coordinates)

In the plane, consider the triangle $\mathbf{p}_1 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, $\mathbf{p}_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $\mathbf{p}_3 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. What are the barycentric coordinates for points $\mathbf{a} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} 1/3 \\ 2/3 \end{bmatrix}$ with respect to the triangle $\mathbf{p}_1\mathbf{p}_2\mathbf{p}_3$? From the barycentric coordinates, tell which of \mathbf{a} and \mathbf{b} is/are located in the interior of the triangle.

Hint The matrix inversion involved in this question is doable by hand. But you may also use symbolic/numerical calculation tool like Wolfram Alpha for computing matrix inversion. ■

Exercise 6.2 — 2 pts. (Interpolation under perspective distortion)

A photograph shows two markers on the ground located 2 and 10 meters away from where the photographer was standing (*i.e.* the z coordinate values in the camera coordinate are 2 and 10 ignoring the minus sign). Suppose there is a bunny sitting on the ground that appears in the photograph to be right at the mid-point between the two markers. How far away was the bunny from where the photographer was standing?



Hint Imagine you are rasterizing a line segment with some vertex attribute whose values are 2 and 10 at the ends, and we have a fragment at the midpoint where the rasterizer would naively take the $\frac{1}{2} : \frac{1}{2}$ average of vertex attributes. What do you have to do to obtain the interpolation of the attribute values that accounts for perspective distortion? ■