

## CSE 167 (FA 2022) Exercise 6 — Due 11/2/2022

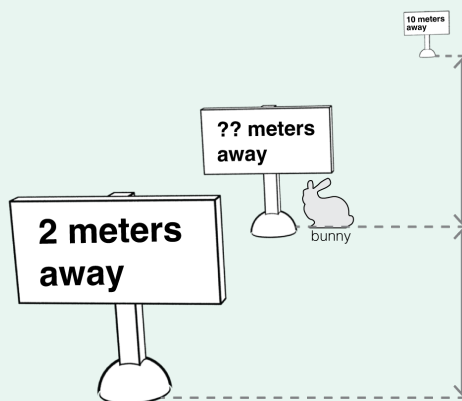
### Exercise 6.1 — 3 pts. (Barycentric coordinates)

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 — 1 pt. (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? ■