Math 155A - Computer Graphics - Winter 2019 - Quiz #7 - March 4, 2019

NAME: Answer Key.

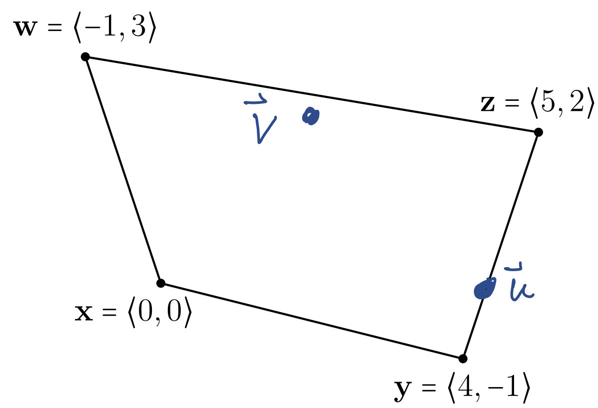
PID:

1. A function $\mathbf{p}(\alpha, \beta)$ is defined by letting $\mathbf{p}(\alpha, \beta)$ be the point with bilinear coordinates α and β for the $\mathbf{x}, \mathbf{y}, \mathbf{z}, \mathbf{u}$ shown in the figure. (So, $\mathbf{p}(0,0) = \mathbf{x}$ and $\mathbf{p}(1,0) = \mathbf{y}$, etc.)

a. Calculate $\mathbf{u} = \mathbf{p}(1, \frac{1}{3})$ (that is, calculate its x, y-coordinates.

b. Show $\mathbf{u}$'s approximate location on the figure.

c. Let $\mathbf{v} = \mathbf{p}(\frac{1}{2}, \frac{9}{10})$. Show its *approximate* location on the figure. (Do not calculates $\mathbf{v}$'s x, y-coordinates.)



(a) This problem is simplified since $\alpha = 1$. Thus:
$\vec{u} = \text{lerp}(\vec{y}, \vec{z}, \frac{1}{3}) = \langle 4\frac{1}{3}, 0 \rangle = \langle \frac{13}{3}, 0 \rangle$

(b) $\vec{u}$ is on right hand edge (since $\alpha = 1$), one-third of the way from $\vec{y}$ to $\vec{z}$ (since $\beta = \frac{1}{3}$).

(c) See figure.

2. Work with homogeneous coordinates representing points in $\mathbb{R}^2$. Let $\mathbf{x} = \langle -4, 0, 2 \rangle$ and $\mathbf{y} = \langle 2, 0, 1 \rangle$.

a. What two points $\mathbf{u}$ and $\mathbf{v}$ in $\mathbb{R}^2$ are represented by the homogeneous coordinates $\mathbf{x}$ and $\mathbf{y}$?

$\langle -2, 0 \rangle$ and $\langle 2, 0 \rangle$

b. What is $\mathbf{z} = \mathit{Lerp}(\mathbf{x}, \mathbf{y}, \frac{1}{2})$? Give your answer as a 3-vector.

$\vec{z} = (1 - \frac{1}{2})\vec{x} + \frac{1}{2}\vec{y} = \langle -1, 0, \frac{3}{2} \rangle$

c. What point in $\mathbb{R}^2$ has $\mathbf{z}$ as a homogeneous representation? Is this the midpoint of $\mathbf{u}$ and $\mathbf{v}$?

$\vec{z}$ represents $\langle \frac{-2}{3}, 0 \rangle$ in $\mathbb{R}^2$.
This is not the midpoint of $\vec{u}$ & $\vec{v}$.