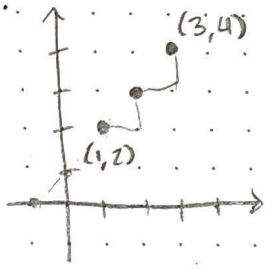
Yasaman Mostafavi A20439542

CS 411 Assignment #1

2a.



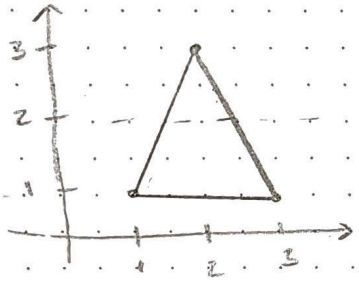
$d_x = 3-1 = 2 \quad d_y = 4-2 = 2$

$d_1 - d_2 = 2m(x_n+1) - 2y_n + 2b - 1$

$d_1 - d_2 = 2\left(\frac{2}{2}\right)(1+1) - 2(2) + 2(1) - 1$

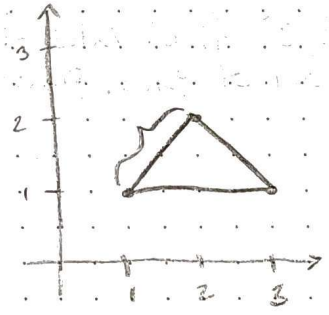
$d_1 - d_2 = 2(2) - 4 + 2 - 1 = \boxed{1}$

2b.



$\boxed{(2,3)}$

2c.



find normal vector b/w (1,1) and (2,2)

$\langle -1, 1\rangle$ and $\langle 1, -1\rangle$

2d. Find projection of A → B A=(2,3) and B=(3,2)

$$\text{comp}_b a = \frac{b \cdot a}{|b|} = \frac{(3\cdot 2)+(2\cdot 3)}{\sqrt{3^2+2^2}} = \frac{12}{\sqrt{13}}$$

2e. Find 2 vectors C and D such that: A=C+D and and $\hat{C}=\hat{B}$

C·D=0

B=(3,2), assume C=(3,2)t

D=(-2a, 3a)

$3t - 2at = 2 \} t = 12/13$

$2t - 3at = 3 \} a = 5/13$

C + D = A

(3,2)t + (-2a, 3a) = (2,3)

(3t, 2t) + (-2at, 3a) = (3t-2at, 2t+3at)

(3t-2at, 2t+3at) = (2,3)

$\boxed{C = \left(\frac{36}{13}, \frac{24}{13}\right)}$

$\boxed{D = \left(\frac{18}{13}, \frac{15}{13}\right)}$

2f. 1. a point is inside the triangle if it is inside with respect to each of its edges, and we can determine this if a point is to the right of an edge.

2. A point is inside a triangle if its barycentric coordinates with respect to the triangle are between 0 and 1

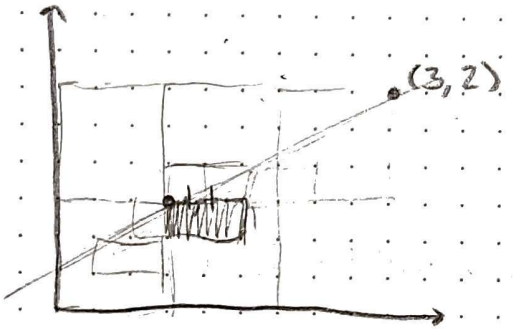
2g. barycentric coordinates of (1.5, 1.0) triangle (1,1)(2,2)(3,1)

$$\alpha = \frac{A(\Delta P_2 P P_3)}{A(\Delta P_1 P_2 P_3)} = \frac{0.75}{1} = 0.75$$

$$\beta = \frac{A(\Delta P_1 P P_3)}{A(\Delta P_1 P_2 P_3)} = 0$$

$$\gamma = \frac{A(\Delta P_1 P P_2)}{A(\Delta P_1 P_2 P_3)} = \frac{0.25}{1} = 0.25$$

2h. Given line segment w/ verticies (1,1)(3,2) find value assigned at (2,1) assuming 3x3 subdivision of each pixel into subpixels.



walking through the image on the left, we can see that at (2,1), there are

2i. kernal $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ × image $\begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$ = middle pixel **18**

$\begin{bmatrix} 2\cdot1 & 2\cdot1 & 2 \\ 2\cdot1 & 2\cdot1 & 2 \\ 2 & 2 & 2 \end{bmatrix}$ corners = **8** $\begin{bmatrix} 2\cdot1 & 2 & 2 \\ 2\cdot1 & 2\cdot1 & 2 \\ 2\cdot1 & 2\cdot1 & 2 \end{bmatrix}$ = **edges 12**

2j. Given RGB pixel array (i.e image) with 100 rows and 200 cols compute the offset (with respect to the beginning of the array) of the blue cell of the pixel (4,5)

how to get to the blue pixel at (4,5) from the start of the array.

$(4 \cdot 100 \cdot 3 + 5) \cdot 3 + 2$

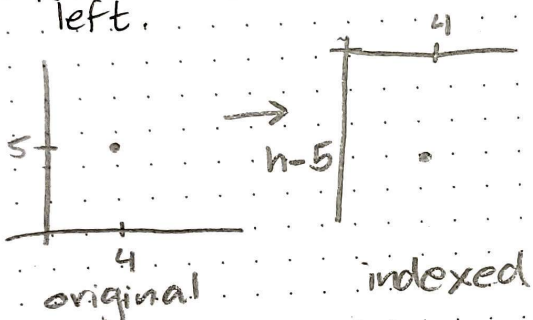
(4 = rows, 100 = width, 3 = RGB, 5 = cols, 3 = RGB, +2 = offset)

0 = red
1 = green
2 = blue

therefore, we get an offset of 1,217.

* assuming top left cordinate system for (4,5)

2k) RGB pixel array with 100 rows, 200 cols, compute the row & col index of an item at (4,5) on the lower left.



row = h-5 = 200-5 = 195

col = 4

arr[195][4]