28.5 pts

30.5

Question 1:

To make a perceptually uniform intensity system with intensities $l_1 = 1, l_2, l_3, l_4, l_5 = 256$:

$l_2 = 4, l_3 = 16, l_4 = 64$

Question 2:

a.

RGB	XYZ	L*a*b*
(0.5, 0, 0)	(0.2062, 0.1063, 0.00965)	(38.95, 63.59, 53.35)
(1, 1, 1)	(0.9505, 0.9998, 1.089)	(99.99, 0.04123, -0.02846)

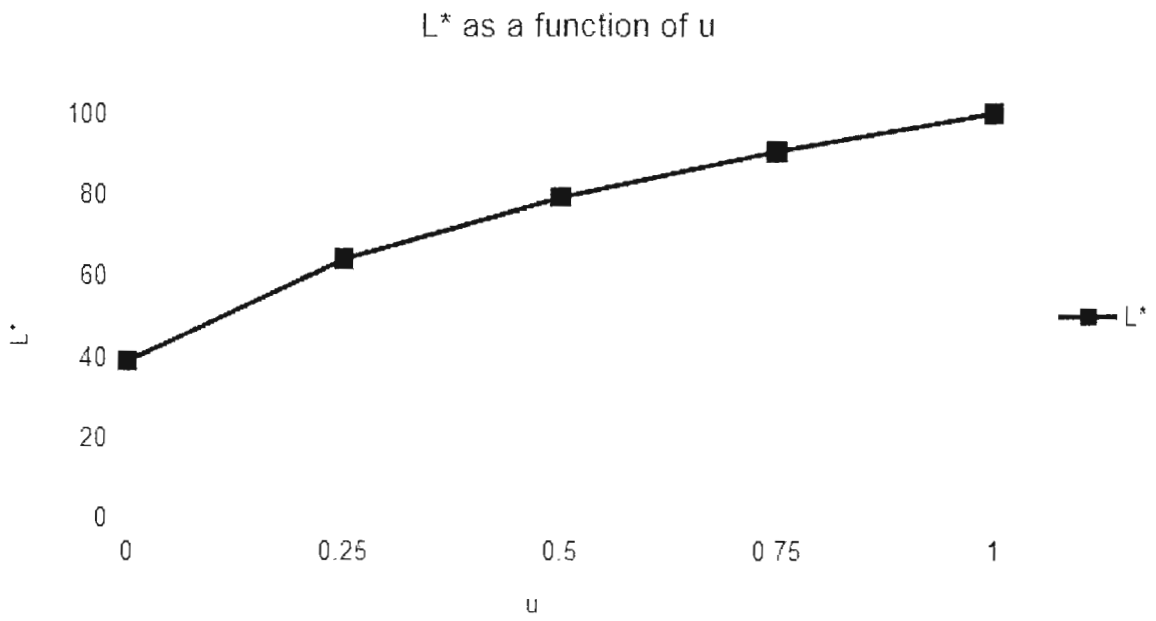
b.

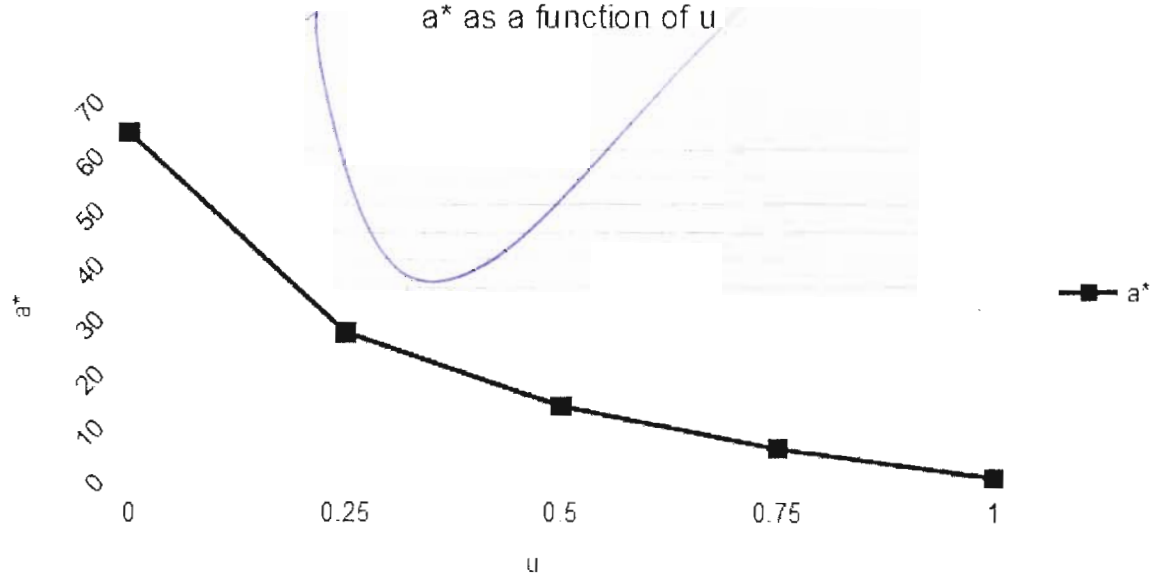
u	RGB
0	(0.5, 0, 0)
0.25	(0.625, 0.25, 0.25)
0.5	(0.75, 0.5, 0.5)
0.75	(0.875, 0.75, 0.75)
1	(1, 1, 1)

c.

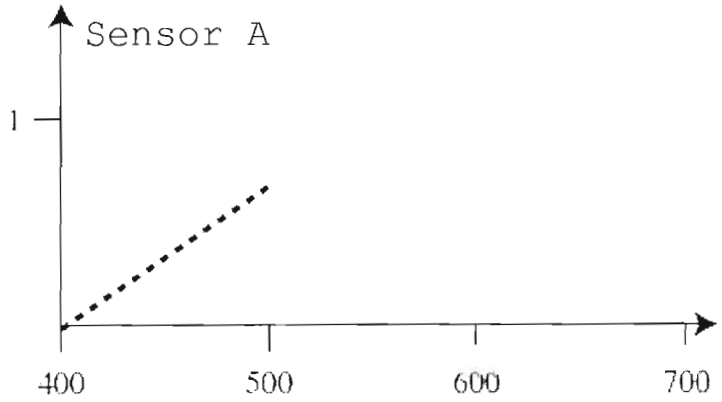
u	XYZ	L*a*b*
0	(0.2062, 0.1063, 0.00965)	(38.95, 63.59, 53.35)
0.25	(0.3923, 0.3297, 0.2795)	(64.13, 26.86, 11.05)
0.5	(0.5784, 0.5531, 0.5493)	(79.22, 13.28, 4.947)
0.75	(0.7644, 0.7764 , 0.8192)	(90.62, 5.430, 1.917)
1	(0.9505, 0.9998, 1.089)	(99.99, 0.04123, -0.02846)

d.

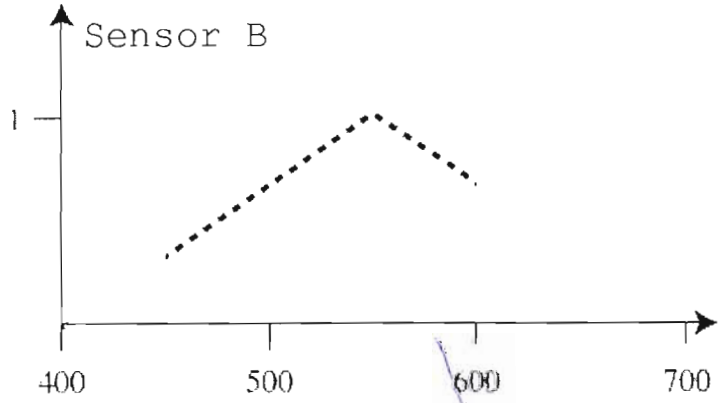

L* as a function of u
100
80
60
40
20
0
L*
0
0.25
0.5
0 75
1
u
L*


a* as a function of u
70
60
50
40
30
20
10
0
a*
0
0.25
0.5
0.75
1
u
a*

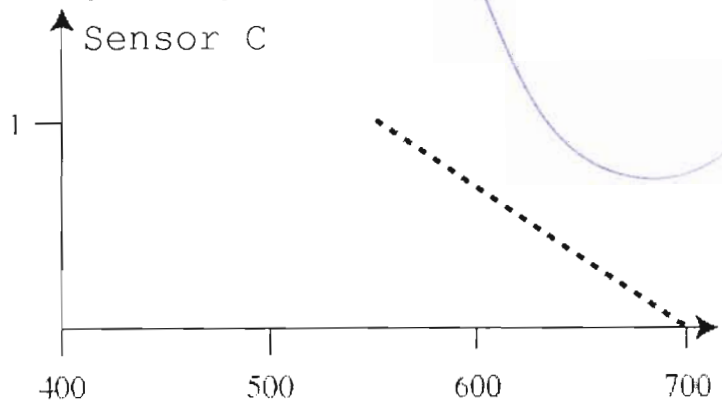
Question 3:



area= $\frac{2}{3} * 100 * \frac{1}{2} = 33\frac{1}{3}$



area= $\frac{1}{3} * 100 + \frac{2}{3} * 100 * \frac{1}{2} + \frac{2}{3} * 50 + \frac{1}{3}50\frac{1}{2} = 108\frac{1}{3}$



area= $150 * \frac{1}{2} = 75$

Question 4:

a. $\begin{bmatrix} 0 & 0 & 0 & 0 \\ -4 & -4 & -4 & -4 \\ -4 & -4 & -4 & -4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ b. $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ c. $\begin{bmatrix} 1 & 0 & -1 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix}$

Question 5:

1d filter mask $= [a_0, a_1, \ldots, a_{i-1}]$ s.t. $a_j = C_j^{i-1}$

1d filtermask for 9:

m $= \frac{1}{256}[1, 8, 28, 56, 70, 56, 28, 8, 1]$ $\frac{1}{256}$ [1, 8, 28, 56, 70, 56, 28, 8, 1]

9x9 filtermask: $= M_{ij} =$m$[i]*$m$[j]$

$\frac{1}{256}$ 65536

$$\begin{bmatrix} 1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1 \\ 8 & 64 & 224 & 448 & 560 & 448 & 224 & 64 & 8 \\ 28 & 224 & 784 & 1568 & 1960 & 1568 & 784 & 224 & 28 \\ 56 & 448 & 1568 & 3136 & 3920 & 3136 & 1568 & 448 & 56 \\ 70 & 560 & 1960 & 3920 & 4900 & 3920 & 1960 & 560 & 70 \\ 56 & 448 & 1568 & 3136 & 3920 & 3136 & 1568 & 448 & 56 \\ 28 & 224 & 784 & 1568 & 1960 & 1568 & 784 & 224 & 28 \\ 8 & 64 & 224 & 448 & 560 & 448 & 224 & 64 & 8 \\ 1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1 \end{bmatrix}$$