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)

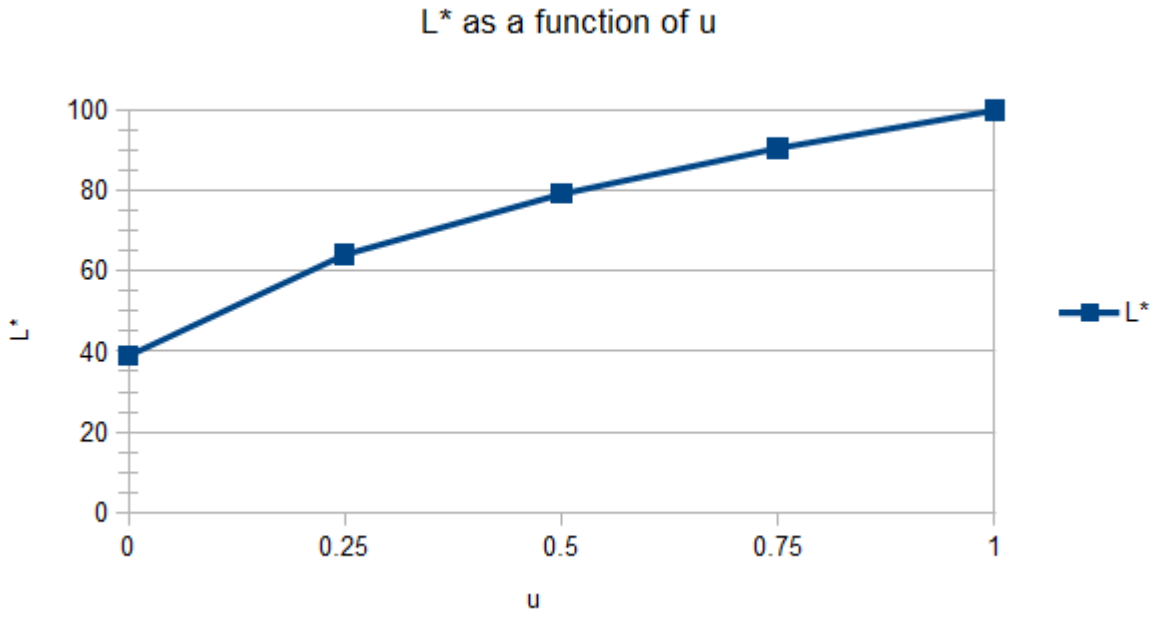
b.

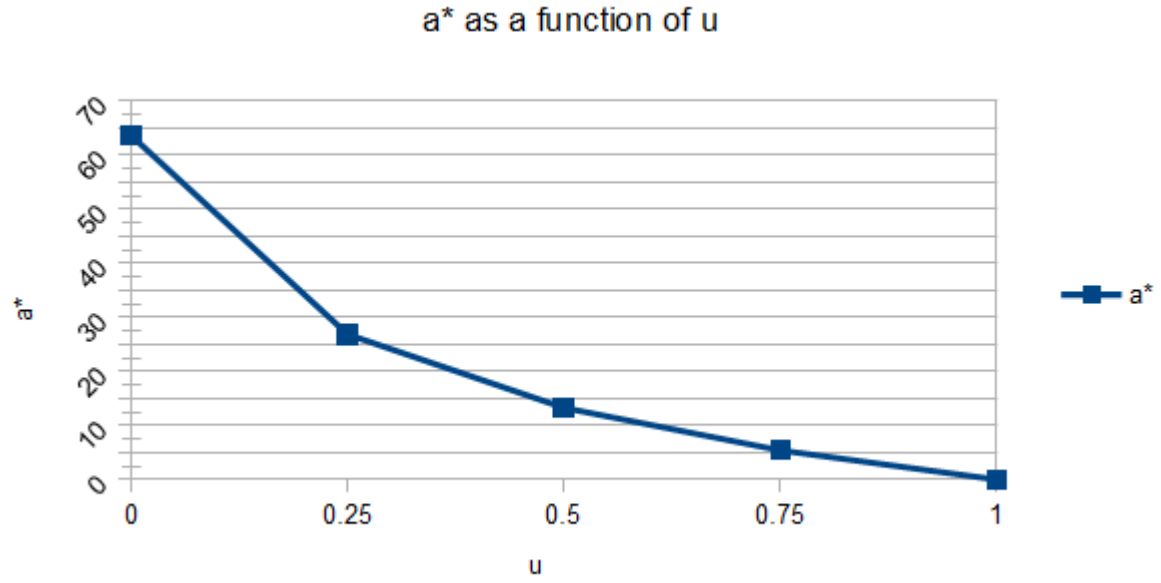
u	RGB		
0	(0.5,	0,	0)
0.25	(0.625,	0.25,	0.25)
0.5	(0.75,	0.5,	0.5)
0.75	(0.875,	0.75,	0.75)
1	(1,	1,	1)

c.

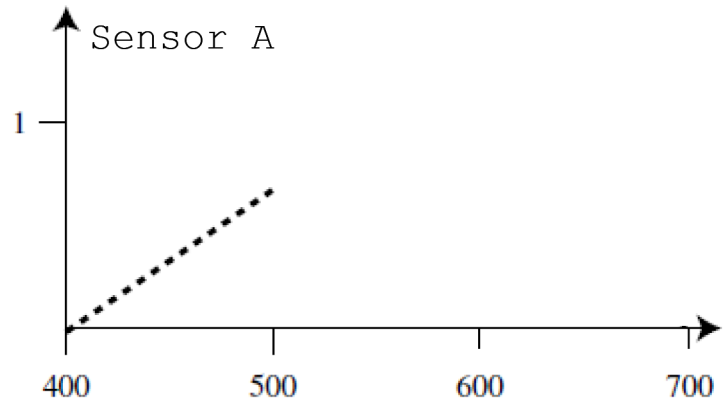
u	XYZ			L*a*b*		
0	(0.2062,	0.1063,	0.00965)	(38.95,	63.59,	53.35)
0.25	(0.3923,	0.3297,	0.2795)	(64.13,	26.86,	11.05)
0.5	(0.5784,	0.5531,	0.5493)	(79.22,	13.28,	4.947)
0.75	(0.7644,	0.7764	, 0.8192)	(90.62,	5.430,	1.917)
1	(0.9505,	0.9998,	1.089)	(99.99,	0.04123,	-0.02846)

d.

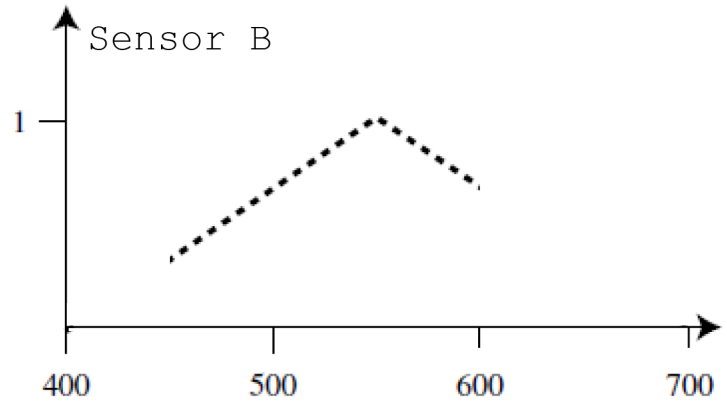

L* as a function of u
100
80
60
40
20
0
L*
0
0.25
0.5
0.75
1
u
L*


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*

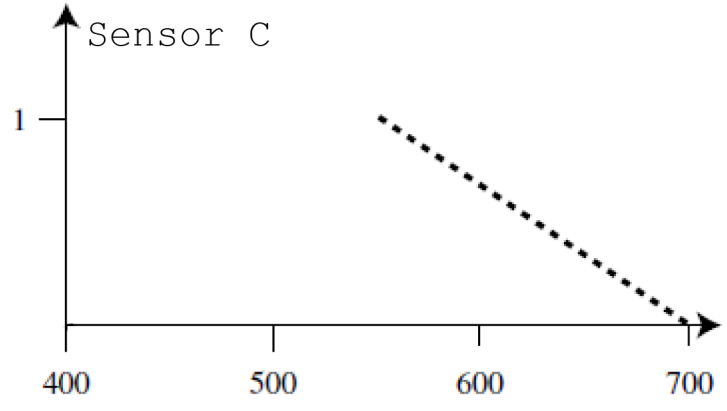
Question 3:



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

1d filtermask for 9:

m = $[1, 8, 28, 56, 70, 56, 28, 8, 1]$

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

$$\frac{1}{256}\begin{bmatrix} 1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1 \\ 8 & 64 & 224 & 448 & 560 & 448 & 224 & 64 & 8 \\ 28 & 224 & 784 & 1568 & 1960 & 1568 & 784 & 224 & 28 \\ 56 & 448 & 1568 & 3136 & 3920 & 3136 & 1568 & 448 & 56 \\ 70 & 560 & 1960 & 3920 & 4900 & 3920 & 1960 & 560 & 70 \\ 56 & 448 & 1568 & 3136 & 3920 & 3136 & 1568 & 448 & 56 \\ 28 & 224 & 784 & 1568 & 1960 & 1568 & 784 & 224 & 28 \\ 8 & 64 & 224 & 448 & 560 & 448 & 224 & 64 & 8 \\ 1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1 \end{bmatrix}$$