

Programming Assignment 1

(Due on September 15, 2018 by 11:59pm)

I. Questions (20%):

(1) (as 2.11) (4%) Consider the two image subsets, S1 and S2, shown in the following figure. For $V = \{1\}$, determine whether these two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) m-adjacent.

	S1					S2				
0	0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	0	1	0	0	1
1	0	0	1	0	1	1	0	0	0	0
0	0	1	1	1	0	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1	1

ANS:

	S_1					S_2				
0	0	0	0	0	0	0	0	1	1	0
1	0	0	1	0	0	0	1	0	0	1
1	0	0	1	0	0	1	0	0	0	0
0	0	1	1	1	0	0	0	0	0	0
0	0	1	1	1	0	0	1	1	1	1

- (a) S1 and S2 **are not 4-adjacent** because q is not in the set $N_4(p)$
 (b) S1 and S2 **are 8-adjacent** because q is in the set $N_8(p)$
 (c) S1 and S2 **are m-adjacent**

(2) (as 2.15) (4%) Consider the image segment shown

(a) Let $V = \{0,1\}$ and compute the lengths of the shortest 4-, 8-, and m-path between p and q . If a particular path does not exist between these two points, explain why.

(b) Repeat for $V = \{1,2\}$.

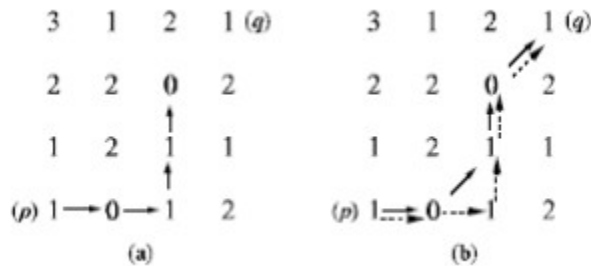
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      3  1  2  1 (q)
      2  2  0  2
      1  2  1  1
(p) 1  0  1  2

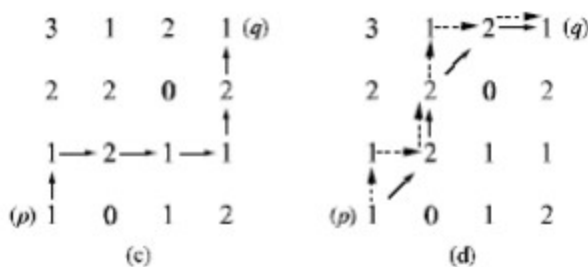
```

Answer:

(a) **4-path does not exist between p and q** because So, we can't go from p to q by traveling along points that are both 4-adjacent and also have values from V . **The shortest 8-path length is 4.** The **length of shortest m-path is 5.** Both of these shortest paths are unique in this case.



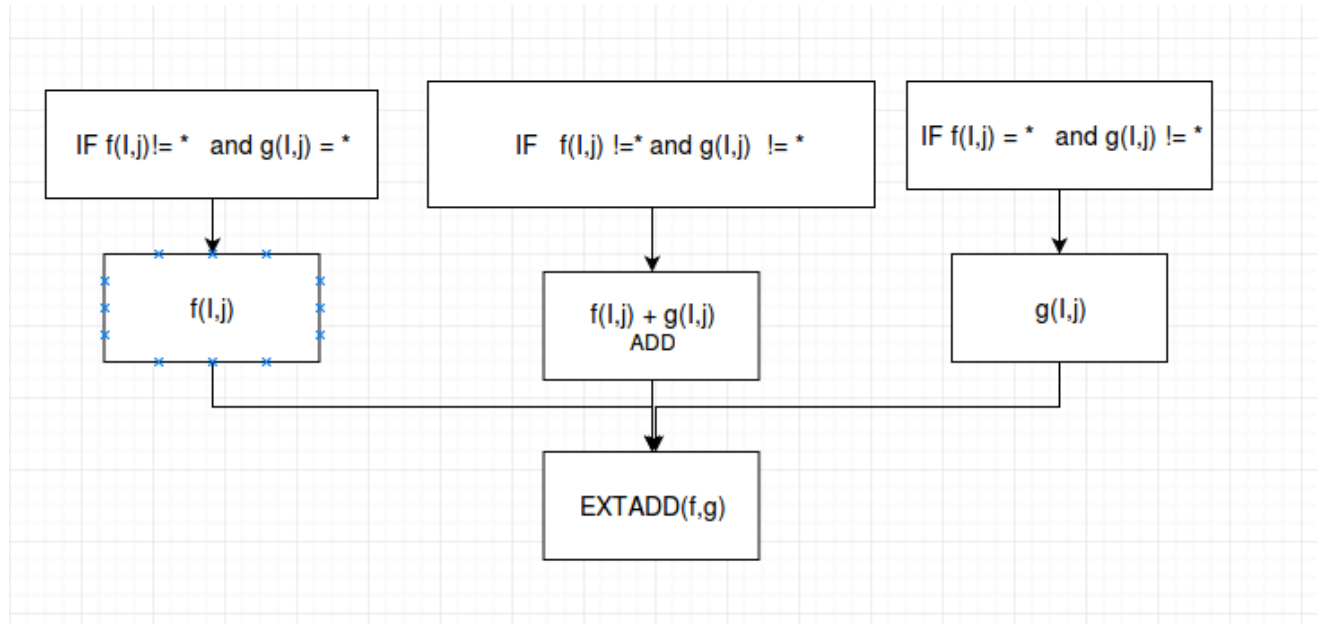
(b) **the shortest 4path when $V = \{1; 2\}$ is 6.** It is easily verified that another 4path of the same length exists between p and q . The shortest **8-path length is 4.** The length of a shortest **m-path is 6.**



(3) Based on the definition of EXTADD(f, g),

(a) (2%) Design a block diagram to realize the EXTADD(f, g) operation using ADD and EXTEND operations.

ANS:



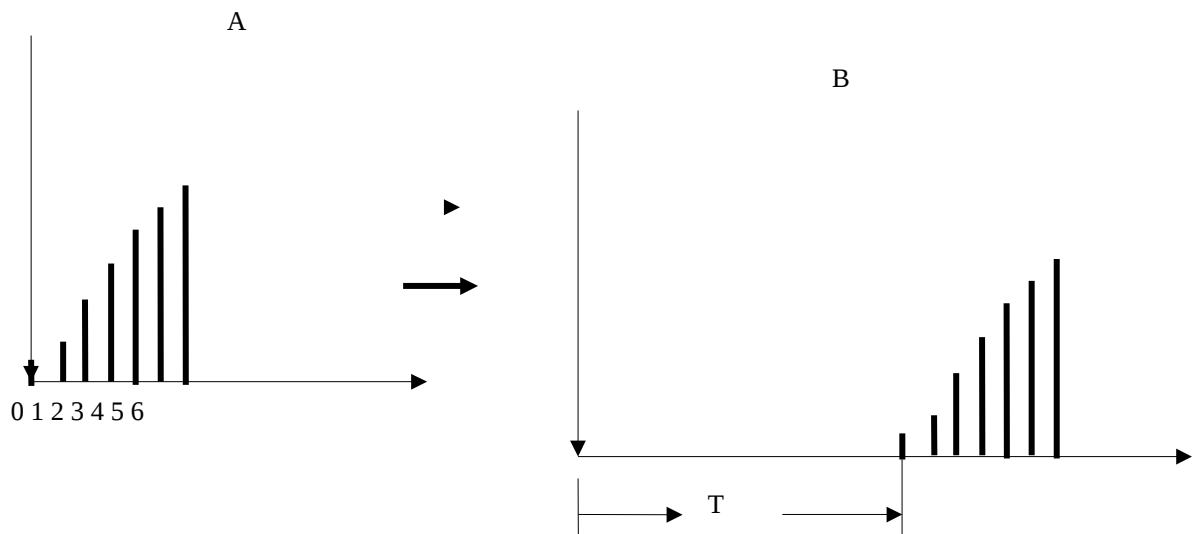
(b) (2%) Compute the EXTADD(f, g), where $f = \begin{pmatrix} 3 & 5 & -2 \\ * & 0 & * \end{pmatrix}_{1,2}$; $g = \begin{pmatrix} 2 & 4 \\ 3 & 9 \\ -2 & * \end{pmatrix}_{2,2}$ _

ANS:

$$\text{EXTADD}(f, g) = \begin{matrix} & * & 2 & 4 \\ 3 & 8 & 7 \\ * & -2 & * \end{matrix}$$

(4) 4%

Given the following histogram (A), after a shifting by T, the histogram becomes (B).
Write a transformation function and plot the transformation curve for such a shifting transformation.

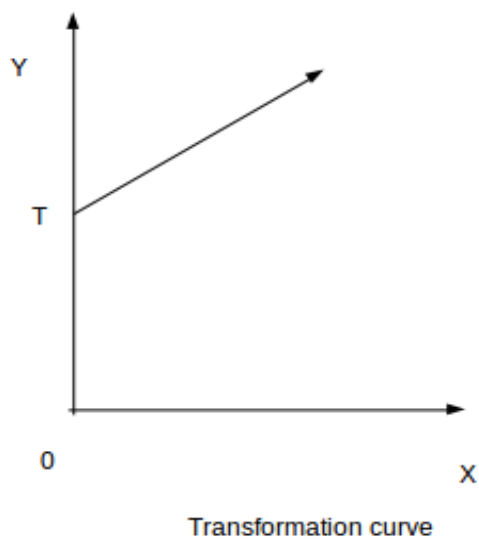


ANS:

The transformation function for the A \rightarrow B histogram is ,

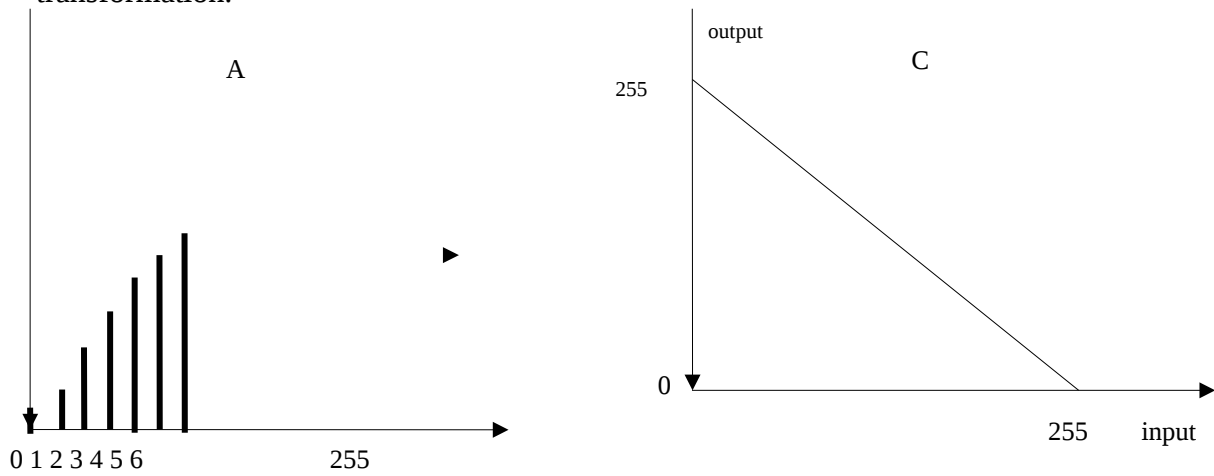
$$\text{HistogramB} = \text{HistogramA}(X - T)$$

The transformation curve for the above transformation function :

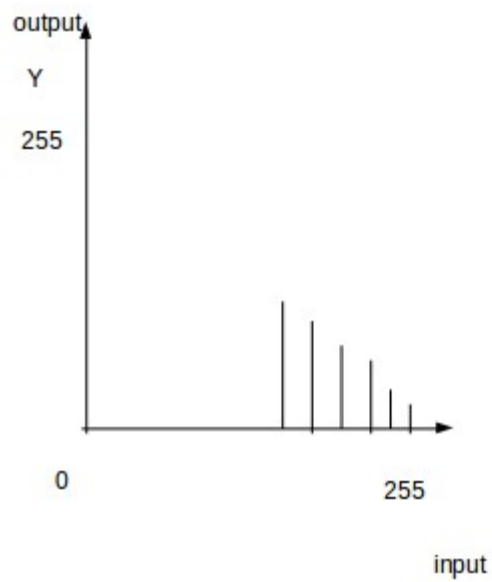


(5) 4%

Give the histogram (A), after applying the transformation (C), plot the new histogram after the transformation.



Ans:



$$s = 255 - r$$