

Home Assignment #2

Digital Image Processing

Fundamentals, Spatial Transformations and Histogram

No Submission

Total Questions: 08

- Q. 1)** A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:
- (a) How many minutes would it take to transmit a 1024×1024 image with 256 gray levels using a 56K baud modem?
 - (b) What would the time be at 750K baud, a representative speed of a phone DSL (digital subscriber line) connection?
- Q. 2)** Using 4-connectivity, perform Connected Component (CC) labeling on the following binary image and show:
- i. The result after first pass of the CC labeling algorithm
 - ii. The equivalence table
 - iii. The final result after the second pass of the labeling algorithm
 - iv. Total number of objects in this image
 - v. Decimate (down sample) this image by a factor of 4 and generate new image

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |

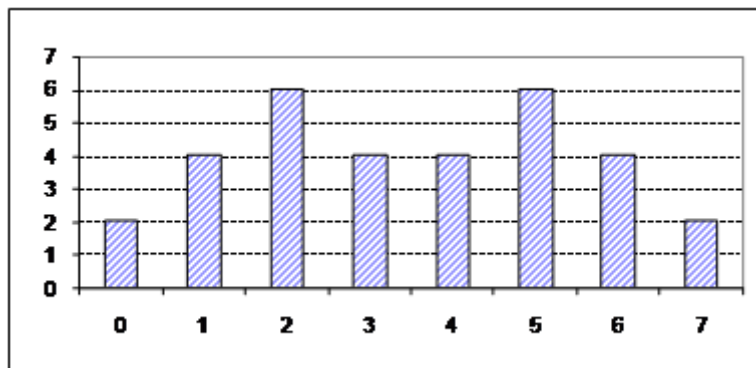
Q. 3) Mathematical expression for a piecewise linear transformation function is given below

$$s = \begin{cases} L - 1 - r, & 0 \leq r \leq 49 \\ 128, & 50 \leq r \leq 99 \\ L - 1 - r, & 100 \leq r \leq 149 \\ 224, & 150 \leq r \leq 199 \\ r, & 200 \leq r \leq 255 \end{cases}$$

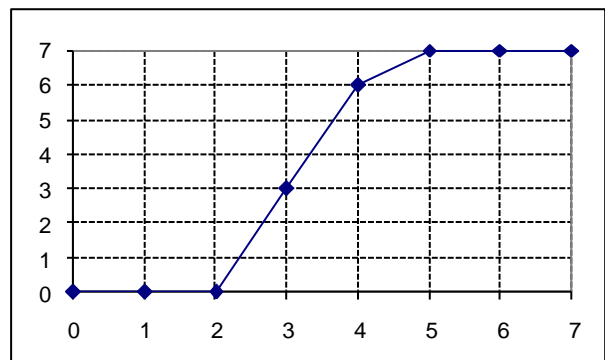
- Draw this transformation for 8 bit image
- Write down the equivalent output intensity values by apply this transformation on following input intensity values of an 8 bit image

30, 160, 76, 225, 135

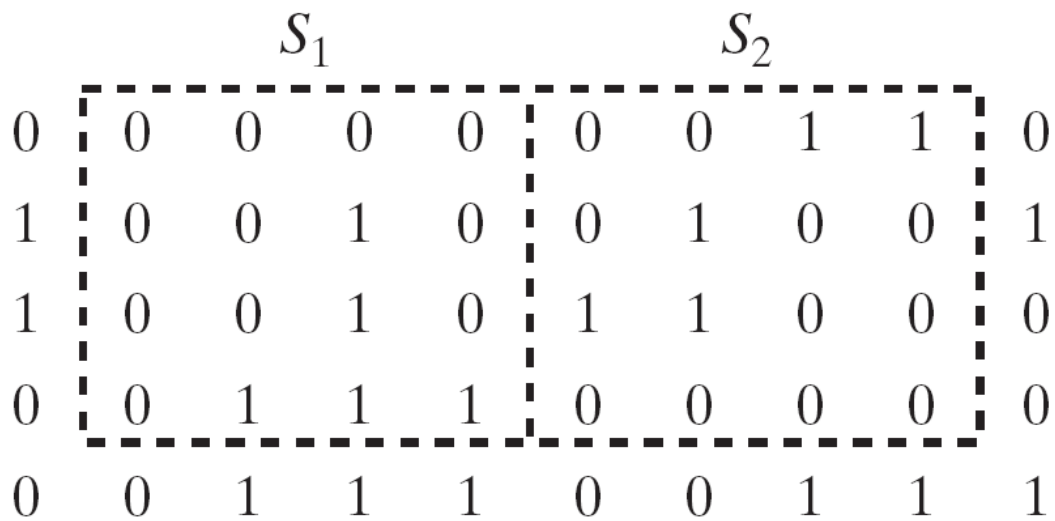
Q. 4) The histogram of a **3-bit** image is shown in the following



What would be the histograms of the output image if the following transformation is applied to this image?



Q. 5) Consider the two image subsets, S_1 and S_2 , shown in the following figure. For $V=\{1\}$, determine whether these two subsets are (a) 4-adjacent, (b) 8-adjacent, or (c) m-adjacent.



Q. 6) (a) What effect would setting to zero the lower-order bit planes have on the histogram of an image in general?

(b) What would be the effect on the histogram if we set to zero the higher order bit planes instead?

Q. 7) Propose a set of gray-level-slicing transformations capable of producing all the individual bit planes of an 8-bit monochrome image. (For example, a transformation function with the property $T(r)=0$ for r in the range $[0, 127]$, and $T(r)=255$ for r in the range $[128, 255]$ produces an image of the 7th bit plane in an 8-bit image.)

Q. 8) You are given by an 8x8 image. Draw its histogram and pdf. Use histogram equalization to get enhanced version of this image. Draw equalized images as well

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|----|----|----|-----|-----|-----|----|----|
| 52 | 55 | 61 | 66 | 70 | 61 | 64 | 73 |
| 63 | 59 | 55 | 90 | 109 | 85 | 69 | 72 |
| 62 | 59 | 68 | 113 | 144 | 104 | 66 | 73 |
| 63 | 58 | 71 | 122 | 154 | 106 | 70 | 69 |
| 67 | 61 | 68 | 104 | 126 | 88 | 68 | 70 |
| 79 | 65 | 60 | 70 | 77 | 68 | 58 | 75 |
| 85 | 71 | 64 | 59 | 55 | 61 | 65 | 83 |
| 87 | 79 | 69 | 68 | 65 | 76 | 78 | 94 |