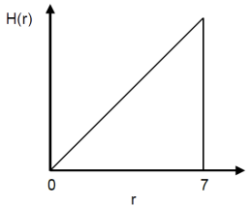
BITS-Pilani, K. K. Birla Goa Campus
Digital Image Processing (EEE F435)
Midsemester Exam, Semester-II (2022-23)
IC: Ashish Chittora

Date: 18/03/2023 **Duration: 90 Minutes**
Maximum marks: 60 **Time: 11.00 AM-12.30 PM**

Note: This is a closed book exam and all questions are compulsory to attempt. Write the answers clearly, with process/steps and final answer at the end. **Write your seat no. on answer sheet at section no. space.**

1. A 50 x70 image has 3-bit pixels. Its histogram looks like a ramp as shown below. The counts in the histogram follow the formula $H(r) = kr$, where k is a constant. [5+5]



   (a) Determine the value of k.
   (b) Compute the mean and standard deviation of this image from the histogram.

2. Filter the given 4 x 4 gray level image with [5+5]
   (a) 3 x 3 weighted mean filter-1 using zero padding with mask.
   (b) 3 x 3 Laplacian filter-2 with given mask and reflecting (repeating) the border pixels.

$$\begin{matrix} 1 & 2 & 4 & 5 \\ 5 & 2 & 5 & 2 \\ 1 & 1 & 3 & 6 \\ 2 & 4 & 6 & 7 \end{matrix}$$

Image

$$w_b = \frac{1}{16}\begin{pmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{pmatrix}$$

Filter-1

$$w_d = \begin{pmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

Filter-2

3. Consider an 8-pixel line of intensity data, (208, 110, 129, 184, 28, 178, 82, 55). If it is uniformly quantized with 4-bit accuracy, compute the rms error and rms signal-to-noise (SNR) ratios for the quantized data. [5+5]

4. Given a four-symbol source {*a*,*b*,*c*,*d*} with source probabilities {0.2, 0.4, 0.3, 0.1}, arithmetically encode the sequence *ccabdc*. And write the final code. [10]

5. Write a MATLAB program to plot and display histogram of a gray image of size 64 x 64 without using imhist() function. (hint functions: sum(), plot()) [10]

6. The 64 x 64 size binary images shown are quite different but their histograms are the same. Suppose each image is blurred with a 3 x 3 averaging filter. (a) Would the histogram of the blurred images still be equal? Explain. (b) If no, sketch the two histograms. (black = 0, White = 255 and each square block is of size 16 x 16, ignore the outer black border). [10]