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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Midterm Examination, Fall 2026
Course Code: CSE437, Course Title: Computer Vision
Level: 4 Term: 3 Batch: 64

Time: 01:30 Hrs **Marks: 25**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	Given the following 5 × 5 grayscale image: $I = \begin{bmatrix} 10 & 10 & 10 & 100 & 100 \\ 10 & 20 & 20 & 110 & 110 \\ 10 & 20 & 30 & 120 & 120 \\ 10 & 20 & 20 & 110 & 110 \\ 10 & 10 & 10 & 100 & 100 \end{bmatrix}$ Apply histogram equalization to the given grayscale image, quantizing the output into 16 intensity levels. Show the gray-level mapping and construct the equalized image matrix.	[5]	CO1
2.	a)	For the following 5 × 5 image I, calculate the Gaussian-filtered value at the center pixel using the given 3 × 3 kernel (with Reflect padding). $I = \begin{bmatrix} 10 & 10 & 10 & 100 & 100 \\ 10 & 20 & 20 & 110 & 110 \\ 10 & 20 & 30 & 120 & 120 \\ 10 & 20 & 20 & 110 & 110 \\ 10 & 10 & 10 & 100 & 100 \end{bmatrix}$	[2]	
	b)	Using the center 3 × 3 region of the ORIGINAL image provided in Question 2(a), calculate G_x and G_y with the Sobel masks. Then determine the gradient magnitude and gradient orientation $\theta = \text{atan2}(G_y, G_x)$, in degrees. Treat both masks as correlation masks (without kernel flipping).	[3]	
3.	a)	For an RGB pixel (120, 180, 60), Determine C_{max}, C_{min} and Δ.	[1]	CO2
	b)	Convert the pixel to HSV by calculating Hue, Saturation and Value. Then convert it to HSI by calculating Hue, Saturation and Intensity using the standard HSI model. Express both Hue values in degrees and all other values in [0, 1].	[4]	
4.	a)	An 8-bit image has the following histogram: Intensity: 20 60 100 140 180 Frequency: 4 5 3 6 2 Calculate the normalized probabilities and the global mean intensity.	[1]	
	b)	Using Otsu's method, analyze candidate thresholds T = 20, 60, 100 and 140. For each T, determine class weights (w_0, w_1) and class means (μ_0, μ_1). Calculate the between-class variance $\sigma^2B = w_0w_1(\mu_0 - \mu_1)^2$ and justify the selection of the optimal threshold . Assume intensity values ≤ T belong to Class 0.	[4]	
5.	a)	Given query descriptor Q = [2, 4, 6, 8] and candidate descriptors D_1 = [3, 5, 7, 9], D_2 = [4, 6, 8, 10] and D_3 = [7, 9, 11, 13], compute all three Euclidean distances.	[2]	
	b)	Identify the nearest and second-nearest candidate descriptors. Apply Lowe's ratio test using $\tau = 0.75$, and determine whether the nearest match is accepted or rejected, and justify your decision. Compute the Hamming distance between B_1 = 10110110 and B_2 = 11010011.	[3]	

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