

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7969

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Unique Paper Code : 2343010028

Name of the Paper : Information and Image Retrieval

Name of the Course : B.Sc.(H) CS

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

छात्रों के लिए निर्देश.

1. Write your Roll No- on the top immediately on receipt of this question paper.
2. **Section A** is compulsory (Question 1).
3. Attempt any 4 questions from **Section B**.
4. Parts of a question should be attempted together.

Section A

- Q1 (a) Name any two low-level features in Information Retrieval. 2
- (b) Given the sentence: "Information retrieval systems retrieve relevant information from documents." 2
- Identify and remove the stop words. Write the final token list.
- (c) Explain the Ranked Retrieval Model in Information Retrieval. 2
- (d) Describe color moments in CBIR systems and their role in image representation. 3
- (e) Define invariant features. Why are they important in CBIR systems? 3
- (f) Discuss any two dimensionality reduction techniques in improving retrieval performance. 3
- (g) Differentiate between stemming and lemmatization. 3
- (h) Given the following feature vectors: 4
- A = [2, 4, 6]
- B = [5, 1, 8]

P.T.O.

Compute the Euclidean and Manhattan distance between A and B.

- (i) Discuss relevance feedback and its impact on retrieval performance. 4
- (j) Explain any two texture features and shape features used in CBIR. 4

Section B

- Q2 (a) Consider the following documents: 5

D1: "data mining and data analysis"

D2: "data science and machine learning"

D3: "analysis of data systems"

- i. Compute the Term Frequency (TF) of the term "data" in D1.
 - ii. Compute the Inverse Document Frequency (IDF) of the term "data".
 - iii. Calculate the TF-IDF value of "data" in D1.
 - (b) A retrieval system returns 30 documents, out of which 18 are relevant. The total number of documents in the collection is 45. 5
 - i. Calculate Precision and Recall
 - ii. Compute the F-measure ($\beta = 1$)
 - (c) Explain the concept of an Inverted Index in Information Retrieval. Describe its structure. 5
- Q3 (a) What is Average Precision? For a query, the relevant documents are retrieved at ranks: 1, 3, and 6. Compute the Average Precision. 5
- (b) Given the following grayscale image: 10

$$\begin{bmatrix} 0 & 1 & 2 & 1 \\ 1 & 0 & 1 & 2 \\ 2 & 1 & 0 & 1 \\ 1 & 2 & 1 & 0 \end{bmatrix}$$

- i. Construct the Gray-Level Co-occurrence Matrix (GLCM) for $\theta = 90^\circ$ and distance $d = 1$.
 - ii. Normalize the GLCM.
 - iii. Compute the Energy of the resultant matrix.
- Q4 (a) Explain the SAR model in image retrieval. How does it help in representing spatial relationships among image regions? 6

- (b) Explain the following similarity measures used in image retrieval systems.: 9
- i. Modified Retrieval Rank (MRR)
 - ii. Average Modified Retrieval Rank (AVMRR)
 - iii. Average Normalized Modified Retrieval Rank (ANMRR)
- Q5 (a) Explain the architecture of the QBIC (Query By Image Content) system in Content-Based Image Retrieval systems. 5
- (b) Discuss the advantages and disadvantages of Text-Based Image Retrieval (TBIR) systems. 5
- (c) What is WebSEEK? Discuss its working and explain the limitations of WebSEEK in Content-Based Image Retrieval systems. 5
- Q6 (a) State curse of dimensionality. What is the necessity of dimensionality reduction. 4
- (b) Explain the autocorrelation in image texture analysis. 5
- (c) An image has 2 colors: Red (R) and Blue (B). 6
- At distance $d = 1$, the following probabilities are given:
- Probability that a pixel of color R has a neighboring pixel of color R = 0.4
- Probability that a pixel of color R has a neighboring pixel of color B = 0.6
- Probability that a pixel of color B has a neighboring pixel of color R = 0.5
- Probability that a pixel of color B has a neighboring pixel of color B = 0.5
- i. Construct the color correlogram matrix.
 - ii. Identify the color pair that has the highest spatial correlation.
 - iii. What does the color correlogram matrix indicate about the image structure?
- Q7 (a) Define Local Binary Pattern (LBP). Write the steps to calculate the LBP value. 5
- (b) Given the average intensity differences for a pixel at different scales: 5
- $$E_1 = 3, E_2 = 7, E_3 = 5, E_4 = 6$$
- i. Identify the scale S with maximum E_k .
 - ii. Compute the coarseness.
 - iii. Describe the texture based on the coarseness value.

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- (c) Differentiate between YIQ model and chromaticity-based color models (HSV/HSI). 5