

Enrollment No.....



Faculty of Engineering
End Sem Examination May-2024
IT3EA10 Pattern Recognition

Programme: B.Tech.

Branch/Specialisation: IT

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. In Bayes theorem, class conditional probability is called as- **1**
 (a) Evidence (b) Likelihood
 (c) Prior Probability (d) Posterior Probability
- ii. In a decision tree, which node is selected as the root node- **1**
 (a) With maximum information gain
 (b) With minimum information gain
 (c) With maximum entropy
 (d) Can't Say
- iii. Which algorithm is used for solving temporal probabilistic reasoning? **1**
 (a) Hill-climbing search (b) Hidden Markov model
 (c) Depth-first search (d) Breadth-first search
- iv. Which of the following statements about the Gaussian distribution is true? **1**
 (a) It is also known as the exponential distribution
 (b) It is a discrete distribution
 (c) It is symmetric around its mean
 (d) It has a long right tail
- v. Which distance metric is commonly used in the kNN algorithm? **1**
 (a) Euclidean distance (b) Manhattan distance
 (c) Hamming distance (d) All of these
- vi. How are principal components ordered in PCA? **1**
 (a) In ascending order of eigenvalues
 (b) In descending order of eigenvalues
 (c) Randomly
 (d) Alphabetically

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- vii. Which is the most common distance metric used in the k-means algorithm? **1**
 (a) Euclidean distance
 (b) Manhattan distance
 (c) Cosine similarity
 (d) Mahalanobis distance
- viii. Which of the following linkage criteria is based on the minimum distance between clusters? **1**
 (a) Single linkage (b) Complete linkage
 (c) Average linkage (d) Ward's linkage
- ix. Which kernel function is commonly used to handle non-linearly separable data in SVM? **1**
 (a) Linear kernel
 (b) Polynomial kernel
 (c) Radial Basis Function (RBF) kernel
 (d) Sigmoid kernel
- x. What is the purpose of using Principal Component Analysis (PCA) in face recognition? **1**
 (a) To reduce the dimensionality of face images
 (b) To extract features from face images
 (c) To align face images to a canonical pose
 (d) To generate synthetic face images for training
- Q.2 i. Define supervised learning with examples. **2**
 ii. Describe how decision tree classify data. **3**
 iii. Explain Bayes theorem for classification, with an example. **5**
- OR iv. What are the different phases of a pattern recognition system? Explain. **5**
- Q.3 i. Explain Gibbs algorithm. **3**
 ii. Derive an expression for maximum likelihood estimation. **7**
- OR iii. Explain the hidden Markov model's evaluation and decoding problems with numerical example. **7**
- Q.4 i. Discuss the problems of high dimensionality. **3**
 ii. Find the class label for point P= (5, 7), with the help of k-nn algorithm **7**

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| Point | Coordinates | Class Label |
|-------|-------------|-------------|
| A1 | (2,10) | C2 |
| A2 | (2, 6) | C1 |
| A3 | (11,11) | C3 |
| A4 | (6, 9) | C2 |
| A5 | (6, 5) | C1 |
| A6 | (1, 2) | C1 |
| A7 | (5, 10) | C2 |
| A8 | (4, 9) | C2 |
| A9 | (10, 12) | C3 |
| A10 | (7, 5) | C1 |

- OR iii. Explain the concept of Principal Component Analysis (PCA) and how it is used in dimensionality reduction. **7**
- Q.5 i. Define clustering. What are types of clustering? **3**
 ii. Explain agglomerative clustering with algorithm and numerical example. **7**
- OR iii. Apply the k-means algorithm to cluster the following eight points (with (x, y) representing locations) into three clusters: **7**
 A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9). Consider value of k=3 where Initial cluster centres are: A1(2, 10), A4(5, 8) and A7(1, 2).
- Q.6 Attempt any two: **5**
 i. Explain the classification process of SVM. **5**
 ii. Discuss the face recognition method. **5**
 iii. Explain the working of optical character recognition system. **5**

Marking Scheme

PATTERN RECOGNITION (PR) IT3EA10

| | | | |
|-----|-------|--|----------|
| Q.1 | i) | In Bayes Theorem, Class conditional probability is called as | 1 |
| | b) | Likelihood | |
| | ii) | In decision tree, which node is selected as root node | 1 |
| | a) | With Maximum Information Gain | |
| | iii) | Which algorithm is used for solving temporal probabilistic reasoning? | 1 |
| | b) | Hidden markov model | |
| | iv) | Which of the following statements about the Gaussian distribution is true? | 1 |
| | c) | It is symmetric around its mean | |
| | v) | Which distance metric is commonly used in the kNN algorithm? | 1 |
| | a) | Euclidean distance | |
| Q.2 | vi) | How are principal components ordered in PCA? | 1 |
| | b) | In descending order of eigenvalues | |
| | vii) | Which is the most common distance metric used in the k-means algorithm? | 1 |
| | a) | Euclidean distance | |
| | viii) | Which of the following linkage criteria is based on the minimum distance between clusters? | 1 |
| | a) | Single linkage | |
| | ix) | Which kernel function is commonly used to handle non-linearly separable data in SVM? | 1 |
| | c) | Radial Basis Function (RBF) kernel | |
| | x) | What is the purpose of using Principal Component Analysis (PCA) in face recognition? | 1 |
| | a) | To reduce the dimensionality of face images | |
| Q.2 | i. | Define supervised learning with examples. | 2 |
| | | Definition | |
| | | Example | |
| | ii. | Describe how decision trees classify data. | 3 |
| OR | | Classification Process | |
| | iii. | Explain Bayes theorem for classification example. | 5 |
| | | 2 Marks | |
| | iv. | What are the different phases of a pattern recognition system? | 5 |
| | | Diagram + all phases | |

Explanation 2 Marks

| | | | | |
|-----|------|---|------------------|----------------|
| Q.3 | i. | Explain Gibbs algorithm. | 3 Marks | 3 |
| | ii. | Derive an expression for maximum likelihood estimation. | | |
| OR | | Complete expression | 7 Marks | 7 |
| | iii. | Explain the hidden Markov model's evaluation problem with numerical | 4 Marks | |
| | | decoding problems with numerical example | 3 Marks | |
| | | | | |
| Q.4 | i. | Discuss the problems of high dimensionality. | 1 Mark for each. | 7 |
| | ii. | Find the class label for point P= (5, 7), with the help of k-nn algorithm | | |
| OR | | Complete Numerical | 7 Marks | |
| | iii. | Explain the concept of Principal Component Analysis (PCA) | 3 Marks | |
| | | how it is used in dimensionality reduction. | 4 Marks | |
| | | | | |
| Q.5 | i. | Define clustering. | 1 Marks | |
| | | What are types of clustering? | 2 Marks | |
| OR | ii. | Explain agglomerative clustering with algorithm | 3 Marks | 7 marks |
| | | numerical example. | 4 Marks | |
| | iii. | Apply the k-means algorithm to cluster the following eight points (with (x, y) representing locations) into three clusters: | | |
| | | A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9). Consider value of k=3 where Initial cluster centres are: A1(2, 10), A4(5, 8) and A7(1, 2). | | |
| Q.6 | | Any two | | 5 |
| | i. | Explain the classification process of SVM. | | |
| | | Definition | 2 Marks | 5 |
| | | Classification process | 3 Marks | |
| | ii. | Discuss the face recognition method | | |
| | | Diagram | 2 Marks | |
| | | Method | 3 Marks | 5 |
| | iii. | Explain the working of optical character recognition system. | | |
| | | Diagram | 2 marks | |
| | | Method | 3 marks | |

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