*Total No. of Questions: 6* *Total No. of Printed Pages:3*

**Enrollment No.....**

# Faculty of Engineering

## End Sem (Even) Examination May-2019

## CS3EA04 / IT3EA04 Pattern Recognition

Programme: B.Tech. Branch/Specialisation: CSE/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.

Q.1 i. Which one of the following is not a phase of pattern recognition system? **1**

(a) Feature Choice (b) Training of classifier

(c) Evaluation of Classifier (d) Building a knowledge base

ii. Feature choice can be done with the help of **1**

(a) Prior knowledge (b) Sensing

(c) Evaluate Classifiers (d) Data Collection

iii. What is meant by notation $p(x|w_i)$, where x is feature and $w_i$ is state of nature: **1**

(a) Likely-hood (b) Prior Probability

(c) Posterior Probability (d) None of these

iv. Discriminant function is type of: **1**

(a) Classifier (b) Clustering Method

(c) Feature Extractor (d) All of these

v. FLDA reduces dimensionality by. **1**

(a) Maximizing distance between mean of different classes and minimizing variability within class

(b) Minimizing distance between mean of different classes and maximizing variability within class

(c) By reducing least square error factor

(d) All of these

vi. Which of the following option is true about k-NN algorithm? **1**

(a) It can be used for classification

(b) It can be used for regression

(c) It can be used in both classification and regression

(d) None of these

vii. Which of the following is incorrect about k-means: **1**
(a) k-means clustering is a method of vector quantization
(b) k-means clustering aims to partition n observations into k clusters
(c) k-nearest neighbour is same as k-means
(d) None of these

viii. Supervised learning differs from unsupervised clustering in that supervised learning requires: **1**
(a) At least one input variable (b) Input attributes to be categorical
(c) At least one output attribute (d) Output attributes to be categorical

ix. The effectiveness of an SVM depends upon: **1**
(a) Selection of Kernel (b) Kernel Parameters
(c) Soft Margin Parameter C (d) All of these

x. Which of the following is a type of SVM? **1**
(a) Maximum margin classifiers (b) Soft margin classifier
(c) Support vector regression (d) All of these

Q.2 i. Define Supervised learning with example. **2**
ii. Define the design process of pattern recognition system in brief. **3**
iii. Draw and explain Bayesian Belief Network with example. **5**
OR iv. For following decision tree calculate entropy, information gain and state which will be root node (split) for decision tree- **5**

| Rec | Age | Income | Student | Credit_Rating | Buys_ Computer |
|---|---|---|---|---|---|
| R1 | <=30 | High | No | Fair | No |
| R2 | <=30 | High | No | Excellent | No |
| R3 | 31..40 | High | No | Fair | Yes |
| R4 | >40 | Medium | No | Fair | Yes |
| R5 | >40 | Low | Yes | Fair | Yes |
| R6 | 31..40 | Low | Yes | Excellent | No |
| R7 | 31..40 | Low | Yes | Excellent | Yes |
| R8 | <=30 | Medium | No | Fair | No |
| R9 | =30 | Low | Yes | Fair | Yes |
| R10 | >30 | Medium | Yes | Fair | Yes |
| R11 | <=30 | Medium | Yes | Excellent | Yes |
| R12 | 31..40 | Medium | No | Excellent | Yes |
| R13 | 31..40 | High | Yes | Fair | Yes |
| R14 | >40 | Medium | No | Excellent | No |

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Q.3 i. Explain how Gibbs sampling works for statistical inference. **3**
ii. Derive the expression for Evaluation problem of HMM and write down forward algorithm. Support your answer with the help of an example. **7**
OR iii. Estimate the parameters using Maximum Likelihood Estimation, for case of Gaussian Distribution. **7**

Q.4 i. State the need of dimensionality reduction. **3**
ii. Compute the Fisher Linear Discriminant projection for the following two-dimensional dataset: **7**
–Samples for class ω1: X1= (x1, x2) = {(4,2), (2,4), (2,3), (3,6), (4,4)}
–Samples for class ω2: X2= (x1, x2) = {(9,10), (6,8), (9,5), (8,7), (10,8)}
OR iii. Illustrate k-nearest neighbour method for non-parametric estimation. **7**

Q.5 i. Define clustering with suitable example. **4**
ii. Explain how unsupervised Bayesian classification works. **6**
OR iii. Write down algorithm for K- means clustering. What are the advantages and disadvantages of this method? **6**

Q.6 Attempt any two:
i. Explain how Support Vector Machine performs image classification. **5**
ii. Explain, how does facial recognition method work. **5**
iii. Write a short note on the "Application of Pattern Recognition for Optical character Recognition." **5**

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# Marking Scheme
## CS3EA04 / IT3EA04 Pattern Recognition

| | | | | |
|---|---|---|---|---|
| Q.1 | i. | Which one of the following is not a phase of pattern recognition system?<br>(d) Building a knowledge base | | **1** |
| | ii. | Feature choice can be done with the help of<br>(a) Prior knowledge | | **1** |
| | iii. | What is meant by notation $p(x\| w_i)$, where x is feature and $w_i$ is state of nature:<br>(a) Likely-hood | | **1** |
| | iv. | Discriminant function is type of:<br>(a) Classifier | | **1** |
| | v. | FLDA reduces dimensionality by.<br>(a) Maximizing distance between mean of different classes and minimizing variability within class | | **1** |
| | vi. | Which of the following option is true about k-NN algorithm?<br>(c) It can be used in both classification and regression | | **1** |
| | vii. | Which of the following is incorrect about k-means:<br>(c) k-nearest neighbour is same as k-means | | **1** |
| | viii. | Supervised learning differs from unsupervised clustering in that supervised learning requires:<br>(b) Input attributes to be categorical | | **1** |
| | ix. | The effectiveness of an SVM depends upon:<br>(d) All of these | | **1** |
| | x. | Which of the following is a type of SVM?<br>(d) All of these | | **1** |
| Q.2 | i. | Define Supervised learning | 1 mark | **2** |
| | | Example. | 1 mark | |
| | ii. | Definition pattern recognition system | 2 marks | **3** |
| | | Diagram | 1 mark | |
| | iii. | Definition Bayesian Belief Network | 2 marks | **5** |
| | | Diagram | 2 marks | |
| | | Example. | 1 mark | |
| OR | iv. | For following decision tree calculate entropy | 2 marks | **5** |
| | | Information gain | 2 marks | |
| | | State which will be root node | 1 mark | |
| Q.3 | i. | Definition Gibbs sampling works for statistical inference. | | **3** |
| | ii. | Expression for Evaluation problem of HMM | 4 marks | **7** |
| | | Forward algorithm | 2 marks | |
| | | Example | 1 mark | |
| OR | iii. | Estimate the parameters using Maximum Likelihood Estimation, for case of Gaussian Distribution. | | **7** |
| | | Introduction | 1 mark | |
| | | Gaussian parameters-Mean | 3 marks | |
| | | Standard Deviation | 3 marks | |
| Q.4 | i. | Need of dimensionality reduction. | | **3** |
| | ii. | Numerical solution | | **7** |
| | | Calculation of first scatter matrix | 3 marks | |
| | | Calculation of second scatter matrix | 3 marks | |
| | | Eigen value, vector calculation | 1 mark | |
| OR | iii. | Definition k-nearest neighbour method | 2 marks | **7** |
| | | Derivation | 5 marks | |
| Q.5 | i. | Definition clustering | 2 marks | **4** |
| | | Example | 2 marks | |
| | ii. | Working of unsupervised Bayesian classification | | **6** |
| OR | iii. | Algorithm for K- means clustering | 3 marks | **6** |
| | | Advantages and disadvantages of this method | 3 marks | |
| Q.6 | | Attempt any two: | | |
| | i. | Working methodology of Support Vector Machine classification. | | **5** |
| | ii. | Explanation - facial recognition method work. | | **5** |
| | iii. | Application of Pattern Recognition for Optical character Recognition | | **5** |

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