OR iii. To which category of clustering schemes does the k-means clustering algorithm belong? State and explain the steps of k-means clustering algorithm with suitable example. **7**

Q.6 Attempt any two:

i. Explain how the process of optical character recognition is done. **5**

ii. State application of pattern recognition in speech recognition system. **5**

iii. What is the goal of the support vector machine (SVM)? How it is different from other classifiers. **5**

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2022

IT3EA04 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.

Q.1 i. In Supervised learning- **1**

(a) Class labels of dependent variable are given in dataset
(b) Class labels of dependent variable are not given
(c) Clusters to be made
(d) None of these

ii. A _____ is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. **1**

(a) Decision tree (b) Graphs
(c) Trees (d) Neural Networks

iii. What is meant by notation $p(w_i|x)$, 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. Which algorithm is used for solving temporal probabilistic reasoning? **1**

(a) Hill-climbing search (b) Hidden Markov Model
(c) Bayes Theorem (d) Breadth-first search

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 Principle component analysis? **1**
(a) PCA is an unsupervised method
(b) It searches for the directions that data have the largest variance
(c) Maximum number of principal components <= number of features
(d) All of these

vii. Which of the following is required by K-means clustering? **1**
(a) Defined distance metric
(b) Number of clusters
(c) Initial guess as to cluster centroids
(d) All of these

viii. In the hierarchical clustering which of the following is not a method for linkage of clusters- **1**
(a) Single (b) Complete (c) Average (d) Incomplete

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. Support vector machine is a- **1**
(a) Supervised learning model
(b) Unsupervised learning model
(c) Semi-supervised learning model
(d) All of these

Q.2 i. Describe the basic modules in designing a pattern recognition system, with the help of suitable diagram. **4**

ii. State and prove Bayes theorem for classification. Illustrate Bayesian Decision Theory. **6**

OR iii. Construct a decision tree for following dataset, take hire as dependent feature. Calculate entropy and information gain of root node. **6**

Major Interest	Experience	Tie	Hire
CS	Programming	Good	No
CS	Programming	Good	No
CS	Management	Good	Yes
CS	Management	Not Good	Yes
Business	Programming	Good	Yes

Business	Programming	Not Good	Yes
Business	Management	Good	No
Business	Management	Good	No

Q.3 i. X is a normally distributed variable with mean $\mu = 30$ and standard deviation $\sigma = 4$. Find p(X). **3**

ii. Discuss the general principal of Maximum likelihood estimation when the distribution is Gaussian. **7**

OR iii. Write HMM Decoding algorithm. With the help of example explain the state sequence decoding of hidden Markov model. **7**

Q.4 i. Differentiate parametric and non-parametric methods of techniques of pattern recognition and classification. **2**

ii. Illustrate the process dimension reduction with principle component analysis, with suitable example. **8**

OR iii. For following dataset, predict the value of Like_cricket for the ID=11, with the help of k-nearest neighbour algorithm, with taking k=5. **8**

ID	Height	Age	Like_cricket
1	5	45	Yes
2	5.11	26	No
3	5.6	30	Yes
4	5.9	34	Yes
5	4.8	40	No
6	5.8	36	Yes
7	5.3	19	Yes
8	5.8	28	No
9	5.5	23	No
10	5.6	32	Yes
11	5.5	38	?

Q.5 i. Compare supervised and unsupervised Bayesian learning. **3**

ii. Which are the two schemes of clustering algorithm. Give a brief description. **7**

Marking Scheme
IT3EA04 Pattern Recognition

Q.1	i.	In Supervised learning- (a) Class labels of dependent variable are given in dataset		**1**
	ii.	A _____ is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. (a) Decision tree		**1**
	iii.	What is meant by notation $p(w_i\|x)$, where x is feature and w_i is state of nature: (c) Posterior Probability		**1**
	iv.	Which algorithm is used for solving temporal probabilistic reasoning? (b) Hidden Markov Model		**1**
	v.	FLDA reduces dimensionality by- (a) Maximizing distance between mean of different classes and Minimizing variability within class		**1**
	vi.	Which of the following option is true about Principle component analysis? (d) All of these		**1**
	vii.	Which of the following is required by K-means clustering? (d) All of these		**1**
	viii.	In the hierarchical clustering which of the following is not a method for linkage of clusters- (d) Incomplete		**1**
	ix.	The effectiveness of an SVM depends upon: (d) All of these		**1**
	x.	Support vector machine is a- (a) Supervised learning model		**1**
Q.2	i.	Diagram	2 Marks	**4**
		Description of module	2 Marks	
	ii.	Statement	2 Marks	**6**
		Proof of Bayes theorem	2 Marks	
		Bayesian Decision Theory.	2 Marks	
OR	iii.	Correct decision tree	2 Marks	**6**
		Calculate entropy of root node.	2 Marks	
		Calculate information gain of root node.	2 Marks	

Q.3	i.	Formula p(X)	1.5 Marks	**3**
		Correct answer	1.5 Marks	
	ii.	Derivation of guassian case by Maximum likelihood estimation	7 Marks	**7**
OR	iii.	Write HMM Decoding algorithm	3 Marks	**7**
		Sequence decoding of hidden Markov model.	2 Marks	
		Example	2 Marks	
Q.4	i.	For each difference	1 Mark each (1 Mark*2)	**2**
	ii.	Illustrate the principle component analysis calculation of covariance matrix	4 Marks	**8**
		Eigen value and eigen vector	4 Marks	
OR	iii.	Calculation of distance from each points	4 Marks	**8**
		Predicting like_Cricket for ID11	4 Marks	
Q.5	i.	Comparison under 3 points	3 Marks	**3**
	ii.	Name: Hierarchical and Partitional	1 Mark	**7**
		Hierarchical Description	3 Marks	
		Partitional description	3 Marks	
OR	iii.	Category of clustering schemes does the k-means	1 Mark	**7**
		State K-means clustering algorithm	3 Marks	
		Explanation	3 Marks	
Q.6		Attempt any two:		
	i.	As per the explanation	5 Marks	**5**
	ii.	As per the explanation	5 Marks	**5**
	iii.	What is the goal of the support vector machine (SVM)?	2.5 Marks	**5**
		How it is different from other classifiers.	2.5 Marks	