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# CS/B.TECH(CSE)/SEM-8/CS-801F/2012 2012 PATTERN RECOGNITION

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

#### GROUP - A

## (Objective Type Questions)

1. Answer *all* questions in brief :

 $10 \times 1 = 10$ 

- i) Define Pattern Recognition.
- ii) What is meant by an N-dimensional pattern space  $\Omega_\chi$  ?
- iii) What are likelihood functions?
- iv) What is clustering?
- v) What is feature vector?
- vi) What do you mean by feature extractor?
- vii) What is feature selection?

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- viii) What are the three learning paradigms in pattern recognition?
- ix) What are the approaches to pattern recognition?
- x) What do you mean by linear discriminate function?

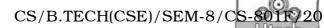
#### **GROUP - B**

### (Short Answer Type Questions)

Answer any *three* of the following.  $3 \times 5 = 15$ 

- 2. Explain Linear Discriminate Analysis (LDA).
- 3. Why is it necessary to establish some rules in the PR problem? What is the way of representing rules? 3 + 2
- 4. Characterize the decision function when each class is characterized by several prototypes.
- 5. What are the different measures of similarity of the assignment of patterns for the domain of a particular cluster centre?
- 6. Explain maximum distance algorithm.

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## **GROUP - C**

## (Long Answer Type Questions)



- 7. a) Describe the basic steps involved in the design of pattern recognition system.
  - b) What is the maximum likelihood ( ML ) estimation ? Show that if the likelihood function is univariate Gaussian with unknowns the mean  $\mu$  as well as variance  $\sigma^2$  , then ML estimates are given by

$$\mu = \frac{1}{N} \sum_{k=1}^{N} X_k \text{ and } \sigma^2 = \frac{1}{N} (X_k - \mu)^2,$$

where  $X_k$  is the kth pattern and N is the total number of training patterns.

c) Compare parametric and non-parametric techniques.

$$6 + 5 + 4$$

- 8. a) What is Bayesian classifier? Prove that it is an optimal classifier.
  - b) In a two class problem with single feature X the pdfs are Gaussian with variance  $\sigma^2=\frac{1}{2}$  for both classes and mean value 0 and I respectively. If  $P(\omega_1)=P(\omega_2)=\frac{1}{2}$ , compute the threshold value  $X_0$  for minimum error probability. 4+5+6

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- 9. a) Define performance index in cluster-seeking problem. 3
  - b) Describe the isodata algorithm to categorize points in different clusters.
- 10. a) What is the form and property of decision functions when the classes are pair-wise separable?
  - b) Explain the classification in XOR problem using LinearDiscriminant Analysis ( LDA ).
- 11. a) Describe the decision-making process in Pattern Recognition which may be treated as a statistical game played by the classifier against nature.
  - b) What is the use of causal network? Explain with an example.

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