Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ECE)/SEM-7/EC-704E/2011-12

2011

PATTERN RECOGNITION AND MACHINE INTELLIGENCE

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
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Depth first search problem can be easily solved using
   a) queue b) stack
   c) link list d) circular queue.

ii) For selection of least cost we use
   a) *A** algorithm b) $\alpha - \beta$ search algorithm
   c) MINIMAX algorithm d) DFS algorithm.

iii) Depth first search is
   a) optimal b) complete
   c) optimal and complete d) none of these.

iv) Genetic algorithm has major application(s), namely
   a) intelligent search b) optimization
   c) machine learning d) all of these.

v) Delta and core point is related to
   a) face matching
   b) fingerprint matching
   c) navigational planning
   d) size invariant matching.

vi) To generate a unique set of weights for one particular class of pattern, we use
   a) supervised learning
   b) unsupervised learning
   c) machine learning
   d) reinforcement learning.

vii) The parameter *m* in fuzzy-*c* means clustering is used
   a) to control the degree of fuzziness of data points in individual classes
   b) to control the location of cluster centres
   c) to eliminate outlier in data sets
   d) to reduce computational overhead.

viii) The covariance matrix in Bayes classifier employs a distance matric called
   a) Mahalanobish distance
   b) Euclidean distance
   c) City block distance
   d) Hausdor distance.

ix) Predicate logic is also called
   a) first order predicate logic
   b) simply first order logic
   c) predicate calculus
   d) all of these.

x) The *k* means clustering algorithm attempts to minimize the Euclidean distance between each cluster centre with
   a) all the points in the problem space
   b) only the points, which are relatively closer to a cluster centre than others
   c) other cluster centres
   d) its nearest cluster centre.

xi) The perceptron neuron employs
   a) a step function as nonlinearity
   b) a parabola as nonlinearity
   c) a sigmoid function as nonlinearity
   d) a signum function as nonlinearity.

xii) Learning refers to adaptation in
   a) weights of a neuron
   b) weights / nonlinearity of a neuron
   c) nonlinearity of a neuron
   d) adaptation in neural response.

GROUP – B
(Short Answer Type Questions)

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

2. What is forward reasoning ? Explain with a suitable example.
3. What is Hill Climbing ? Explain the procedure of Hill Climbing.
4. Discuss the steps of Depth First Search algorithm using stacks.
5. How are cognition, training and recognition interrelated ?
6. Explain the procedure of *A** algorithm with a suitable example.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. What are the different learning schemes ? What is the difference between Unsupervised Learning and Reinforcement Learning ? State and explain *Q*-learning algorithm with an example. 2 + 3 + 10
8. What is the structure of production rules ? Describe about typical architecture of production system. What is the function of working memory and control unit in production system ? 6 + 6 + 3

9. a) Given an objective function

$$J = \sum_{i=1}^{n} \sum_{j=1}^{k} \left\| \vec{x}_i - \vec{c}_j \right\|^2$$

$$x_i \ \varepsilon \ class_j$$

where $\vec{x}_i$ are the data points for $i = 1$ to n,

$\vec{c}_j$ are j-th cluster centre for $j = 1$ to k.

Minimize J by setting $\frac{\partial J}{\partial \vec{c}_j} = 0$, and hence evaluate $\vec{c}_j$.

b) What does the result in part (a) logically indicate ?

c) How do you check whether $x_i \ \varepsilon \ class_j$?

d) How at the end of k means algorithm, do you determine the data points falling in a given $class_j$? 8 + 2 + 2 + 3

10. a) Explain the main points of Fuzzy-c means clustering algorithm.

b) Write the basic steps of principal component analysis (PCA) algorithm.

c) What is the basic difference between Bayesian reasoning and Dempster-Shafer theory ? 6 + 5 + 4

11. Write short notes on any *two* of the following : 2 × 7½

a) Hotelling transform

b) Decision tree

c) Pattern clustering

d) Machine learning algorithm

e) Paerl's evidential reasoning.

==========