	<u>Unean</u>
Name :	\ \
Roll No. :	(A American consider)
Invigilator's Signature :	

CS/B.Tech(ECE-NEW)/SEM-7/EC-704E/2009-10 2009

PATTERN RECOGNITION & 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)

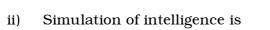
- 1. Choose the correct alternatives of the following: $10 \times 1 = 10$
 - i) "The computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the response come from a human being or machine."

Above definition belongs to which one of the following tests?

- a) Searle's test
- b) Turing test
- c) Shannon's test
- d) Weizenbaum test.

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- a) Strong AI
- b) Average AI
- c) Weak AI
- d) Very strong AI.
- iii) Depth first search is
 - a) optimal
- b) complete
- c) all of these
- d) none of these.
- iv) The space complexity of depth first search is which one of the following when b is a branching factor and m is a maximum depth?
 - a) O(bm)
- b) O (mb)
- c) O(b+m)
- d) none of these.
- v) Alpha beta pruning achieves same optimal moves a minimax but achieves improved efficiency by eliminating sub-trees which are
 - a) at higher cost
- b) at lower cost
- c) provably irrelevant
- d) none of these.
- vi) For any two events x_1 , x_2 and a background evidence E, $P(x_1, x_2/E) = P(x_2/E)$, $P(x_1/E)$ holds good when
 - a) x_1 and x_2 are independent
 - b) x_1 is independent of E, but x_2 is dependent of E
 - c) x_1 , x_2 and E are independent
 - d) x_1 and x_2 are dependent on E.

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vii) In k-means chestering

- a) a point may be mapped into more than one classes
- b) all points are mapped on to a single class
- c) each point is mapped to its nearest class
- d) no more than one point is mapped on to a class.

viii) Non-linearity in a neuron maps is

- a) an infinite domain to a finite range
- b) a finite domain to an infinite range
- c) a finite domain to a finite range
- d) an infinite domain to an infinite range.

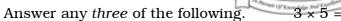
ix) The belief Bel $\{A, B\}$ is defined by

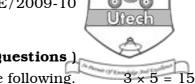
- a) algebraic sum of Bel $\{A\}$ and Bel $\{B\}$
- b) orthogonal sum of Bel $\{A\}$ and Bel $\{B\}$
- c) logical minimum of Bel $\{A\}$ and Bel $\{B\}$
- d) logical product of Bel $\{A\}$ and Bel $\{B\}$.

x) Bayes' classifier employs

- a) Maholanobis distance
- b) Euclidean distance
- c) city-block distance
- d) any non-Euclidean distance metric.

GROUP – B (Short Answer Type Questions)





- 2. Define in your own words the following terms :
 - a) State
 - b) State space
 - c) Search tree
 - d) Search node
 - e) Goal
 - f) Branching factor.
- 3. Discuss the steps of depth first search algorithm using stacks.
- 4. What is forward reasoning? Explain with a suitable example.
- 5. Given an axiomatic theory $T = \{ \Box P \Box Q, Q \}$. Prove that $Q = \{ \Box P \Box Q, Q \}$. Prove that $Q = \{ \Box P \Box Q, Q \}$. Prove that $Q = \{ \Box P \Box Q, Q \}$.
- 6. Construct the weight matrix for a discrete Hopfield net for the following desired stable states :

$$X_1 = [1 - 1 1]$$

$$X_2 = \begin{bmatrix} -1 & 1 & -1 \end{bmatrix}$$

and
$$X_3 = [-1 \ -1 \ 1].$$

GROUP - C

(Long Answer Type Questions) Answer any *three* of the following. $3 \times 15 = 45$



- The missionaries and cannibals probem is usually stated as 7. follows: Five missionaries and four cannibals are on one side of a river, along with a boat that can hold at a time one or two people find a way to get everyone to the other side, without everleaving a group of missionaries with excess cannibals.
 - Construct a set of production rules for the missionariesa) cannibals problem.
 - b) Show the solution to the problem by the space search.8 + 7
- 8. a) Discuss the steps of breadth first search algorithm. Also explain the order of traversal using tree of depth three.
 - b) What is Hill-climbing? Explain its procedure using stack. 6 + 6 + 3
- Consider the following set of data points: 9. a)

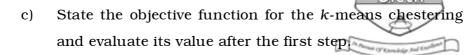
$$(x_1, x_2) \quad [\{(1, 1), (2, 2), (2, 1), (5, 1), (6, 2), (7, 1)\}.$$

Initialize
$$c_1 \int (x_1, x_2) = (1, 2)$$
 and $c_2 \int (x_1, x_2) = (7, 2)$ as two random chester centres.

Show one step of execution of the k-means dustering and hence determine the updated cluster centres.

What condition do you set to check convergence of the b) algorithm?

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- d) How does fuzzy C-means chestering differ from the k-means algorithm ? 6+2+4+3
- 10. a) Find the eigenvalues of the following matrix :

$$A = \left(\begin{array}{ccc} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{array}\right)$$

and hence determine the principal eigenvector.

- b) How can principal component analysis be used for face recognition? (6+2)+7
- 11. Consider the following piece of knowledge:
 - a) Tony, Mike and John are members of Himalaya Club (H-C)
 - b) Every Himalaya Club member who is not a skier is a mountain climber.
 - c) Mountain climbers do not like rains.
 - d) Anyone who does not lie snow is not a skier.
 - e) Mike dislikes whatever Tony likes and likes whatever Toney dislikes.

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f) Tony likes rain and

Represent this knowledge as a predicate statements appropriate for a backward rule based deduction system. Show how such a system would answer the query "Is there a member of Himalaya Club who is not a mountain climber but a skier" by using resolution principle.

- 12. Write short notes on any *three* of the following : 3×5
 - a) Application of pattern recognition and machine intelligence
 - b) Genetic Algorithm (GA)
 - c) Abductive reasoning using Fuzzy logic
 - d) Application of back-propagation neural network in pattern classification problem
 - e) Bayes' classifier.

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