

Indian Institute of Engineering Science & Technology, Shibpur

B. Tech - M. Tech Dual Degree Part IV Examination

8<sup>th</sup> Semester Final Examination, April 2018

Artificial Intelligence (CS- 801)

Time-3 Hours

Full Marks-70

Use one Answer script.

All questions are of equal marks.

Answer any FIVE questions taking at least ONE from each group.

Group-A

1. a) Define Resolution in Propositional Logic. Justify proof by Resolution-refutation.  
Write an algorithm for solving problem using Resolution in Propositional Logic.  
b) Heads I Win. Tails You Lose. Use Resolution in PL to prove: I Win.  $[(1+4+4) + 5]$
2. a) Define Skolem Standard Form, Clause Form. Write an algorithm to convert a Prenex Conjunctive Normal Form formula into Clause Form formula.  
b) i) Let L be the list of even numbered elements. Write a PROLOG program to delete two middle elements and obtain the resultant list in L1.  
ii) Let L be a list of odd numbered elements. Write a PROLOG program Unfold(L, L1), such that elements from 1 to  $(\frac{n}{2} - 1)$  and from  $(\frac{n}{2} + 1)$  to n are reversed in L1.  
iii) Write a PROLOG program to determine whether a list is a palindrome.  $[(2+4) + (3+3+2)]$
3. a) Given postorder and inorder traversals of a binary tree. Write a Prolog program to obtain preorder traversal of the same binary tree.  
b) Given is a list of arcs in the form [ arc(3,2), arc(4,1),.....]. Write PROLOG programs to perform the following tasks:
  - i) Test if the arcs in the given list can be rearranged into a continuous path of the form [ arc(3,2), arc(2,4), arc(4,1),...], and if so, return the continuous path.
  - ii) Test if the arcs in the given list form a cycle, that is, a continuous path of which last arc can be joined to the first one.  $[6+(4+4)]$

Group-B

4. a) What is heuristic? Write an algorithm for Hill Climbing search considering the search space to be a graph. Can Hill Climbing search always find optimal path to the goal? - Explain your answer. What is a macro-operator in context to Hill Climbing search?  
b) What problem of A\* algorithm is solved by IDA\* algorithm and how? - Discuss with a suitable example.  $[(1+4+3+2) + 4]$

5. Why does Games have important role in AI? Give an example each for perfect and deterministic, imperfect and deterministic, perfect and non-deterministic, imperfect and non-deterministic game. What are static evaluation function and utility function in a perfect two-player deterministic games? Write MiniMax procedure for a perfect two-player deterministic game? Explain alpha-beta pruning with a suitable example and hence re-write MiniMax procedure with alpha-beta pruning for perfect two-player deterministic games. [1+2+2+3+3+3]

Group-C

6. a) What is a Production System model of problem solving? How is it similar to human problem solving model? Mention any three conflict resolution strategies. What are forward chaining and backward chaining in Production System model of problem solving? – Explain with a suitable example.
- b) *There is a monkey at the door into a room. In the middle of the room a banana is hanging from the ceiling. The monkey is hungry and wants to get the banana, but he cannot stretch high enough from the floor. At the window of the room there is a box that the monkey can use. The monkey can perform the following actions: walk on the floor, climb the box, push the box around (if he is already at it), and grasp the banana if he is standing on the box and directly underneath the banana. Can the monkey grasp the banana?*  
Write a PROLOG program to obtain the answer to the above query. [(2+1+3+3) +5]
7. a) Draw a diagram of Rule Based Expert System Architecture and mark the Expert System Shell in it. What is the advantage of an Expert System Cell?
- b) What are the motivational factors of Machine Learning? Why and how does bagging improve the performance of a single classifier?
- c) Why is pruning necessary in a decision tree model? Discuss Minimum Description Length tree pruning method. [(2+1) +(3+3) +(2+3)]
8. a) Write PRISM algorithm for inducing rules.
- b) Consider the following data set on the next page where decision attribute is whether a patient should be fitted with soft contact lenses, hard contact lenses or no contact lens at all. Obtain all rules for fitting a patient with hard contact lenses using PRISM algorithm, showing all steps. [5+9]

