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VI SEMESTER **B.Tech. (MCE)**

END TERM EXAMINATION ***May-2024***

COURSE CODE: MC312 **COURSE TITLE: Artificial Intelligence**

Time: 03 Hours ***Max. Marks: 40***

Note : Attempt **any five** questions. All the questions are of 8 marks each. Assume suitable missing data, if any.

Q.1. (a). What is BACKTRACKING in Prolog? Explain with a program in Prolog. [4 marks][CO5]

(b). Discuss, with an example, the concept of CUTS in Prolog.

[4 marks] [CO5]

Q.2. (a) Given the following facts/axioms:

$$P \vee Q, \quad Q \rightarrow R, \quad P \rightarrow S, \quad \neg S.$$

Prove that "R" is true by resolution. [3 marks] [CO6]

(b). Given the SAT problem with 5 clauses:

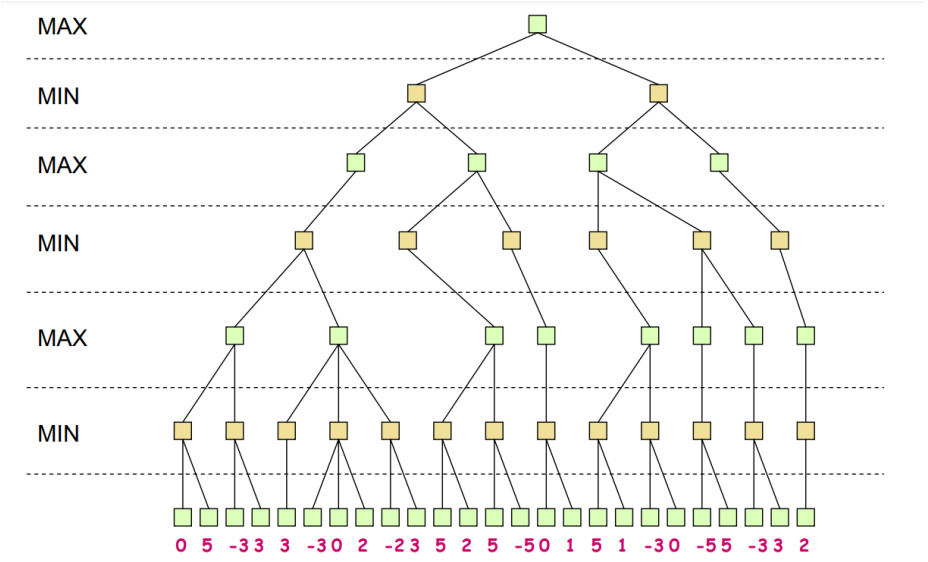
$(\neg a \vee d) \wedge (c \vee b) \wedge (\neg c \vee d) \wedge (\neg b \vee \neg d) \wedge (a \vee \neg d)$.

Assume that the heuristic function is number of clauses satisfied. Let the solution vector be in the order (a,b,c,d) and let the initial candidate is (0,0,0,0). Show three expansions of tabu search assuming tabu tenure is 2. Show the new candidate as well as the tabu moves at each of three stages. [5 marks][CO2]

Q.3. (a). Explain Sussman's Anomaly in Goal Stack Planning with the help of an example. [3 marks][CO2]

(b). Given an initial state: {ON (B, A) ∧ ONTABLE (A) ∧ ONTABLE(C) ∧ ONTABLE(D) ∧ ARMEMPTY}, and the goal state as: {ON(C, A) ∧ ON(B,D) ∧ ONTABLE(A) ∧ ONTABLE(D)}. How can the goal state be achieved with Goal Stack Planning ? Explain all the steps involved. [5 marks] [CO3]

Q.4. (a) Consider a game tree given below that consists of alternate levels for MAX and MIN players. The evaluation function for each of the leaf nodes is written in the last level. The evaluation function values for the leaf nodes starting from the leftmost leaf to the rightmost leaf node is {0, 5, -3, 3, 3, -3, 0, 2, -2, 3, 5, 2, 5, -5, 0, 1, 5, 1, -3, 0, -5, 5, -3, 3, 2}. Evaluate the number of alpha cutoffs and beta cutoffs on the game tree if we apply the Alpha-Beta pruning technique on this given tree. Also, describe which leaf nodes will be evaluated and which leaf nodes will be pruned with Alpha-Beta pruning. [5 marks][CO3]



(b). How do you define the term "*Strategy*" in game playing algorithms with respect to MAX player ? Given a 4-ply game tree with MAX at the root, how many strategies exist for the MAX player ?

[3 marks][CO3]

Q.5. Consider the following sentences:

(i) John likes all kinds of food.

(ii) Apples are food.

(iii) Chicken is food.

(iv) Anything anyone eats and if he/she is not killed by is food.

(v) Bill eats peanuts and is still alive.

(vi) Sue eats everything Bill eats.

Translate the above sentences into formulas in Predicate Logic. Further, prove that the statement "John likes peanuts" is true using predicate logic. [8 marks][CO6]

Q.6. Compare the DFS and BFS algorithms in state space search on the basis of time complexity, space complexity, completeness and quality of solution by representing your analysis with suitable diagrams and mathematical analysis as applicable. [8 marks][CO4]

Q.7. (a). Differentiate between Forward State Space Planning and Backward State Space Planning with an example. [4 marks][CO1]

(b). Explain the difference Hill Climbing and Beam search techniques with an example. [4 marks] [CO1]

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