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INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

B. Tech. (IT) 8th Semester Final Examination, 2022

Subject: Artificial Intelligence (IT-802)

Full marks: 30 Time: 2 Hours

Answer any five Questions

1. Prove or disprove that if the f values of the nodes in the search tree are monotonically non-decreasing, then the heuristic (h) is admissible. Prove that if a heuristic is consistent, it must be admissible. Explain the differences between recursive BFS (best first search) and simple memory bounded A* algorithm.

2+2+2

2. Explain the role of pattern database for inventing heuristic. Discuss some potential drawbacks of using hill climbing search. How can we overcome the drawbacks?

2+4

3. Define a 'game' formally. The standard alpha-beta algorithm performs a depth-first exploration (to a pre-specified depth) of the game tree. Can alpha-beta be generalized to do a breadth-first exploration of the game tree and still get the optimal answer? Explain how or why not.
Consider a binary tree as game tree. The root node is the MAX node. The utility values of the leaf nodes from right to left of the tree are 10,7,8,9,12,11,12,5,8,9,8,12,11,7,5,10. Find out the minimax value, alpha and beta cut off points with proper explanation.

1+2+3

4. Prove that implication is transitive in propositional logic. Two clauses are semantically distinct if they are not logically equivalent. How many semantically distinct 2-CNF clauses can be constructed from N proposition symbols? What are the advantages of predicate calculus over propositional calculus (logic) in knowledge representation?

2+2 +2

5. Prove that the formula $\exists x\ P(x) \rightarrow \forall x\ P(x)$ is always true if the domain D contains only one element. What is the need of most general unifier (mgu) in the context of unification? Sam, Clyde and Oscar are elephants. We know the following facts about them: Sam is pink. Clyde is gray. Clyde likes Oscar. Oscar is either pink or gray (but not both). Oscar likes Sam.
Use resolution refutation to prove that a gray elephant likes a pink elephant.

1+2+3

6 Draw a semantic network representing the following knowledge: Every vehicle is a physical object. Every car is a vehicle. Every car has four wheels. Electrical system is a part of car. Battery is a part of electrical system. Pollution system is a part of every vehicle. Vehicle is used in transportation. Swift is a car.

What are the advantages of expert system? Explain the inference process of an expert system.

3+1+2

7. a) Explain the use of 'fail' for negation in Prolog.

b) Write Prolog program for the following:

i) Shift the content of a list towards left by two elements.

ii) Split a list of numbers into two lists: positive ones (including zero) and negative ones.

iii) Merge two sorted list of numbers into a sorted list.

2+4