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VI SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING) END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: ELECTIVE - II- ARTIFICIAL INTELLIGENCE [CSE 4009]

REVISED CREDIT SYSTEM (24/04/2018)

Time: 3 Hours

MAX. MARKS: 50

4M

Instructions to Candidates:

Missing data may be suitable assumed.

- **1A.** Explain the four different approaches of Artificial Intelligence.
- 1B. You have 3 jugs, measuring 12 gallons, 8 gallons, and 3 gallons, and a water pump. 4M You can fill the jugs up or empty them out from one to another or onto the ground. You need to measure out exactly one gallon.
 - (i) Give the initial state, goal test, successor function, and cost function for each. Choose a formulation that is precise enough to be implemented.
 - (ii) Provide a PEAS description of this task environment.
- 1C. Consider a vacuum cleaner agent environment, in which the geography of the environment its extent, boundaries, and obstacles is unknown, as is the initial dirt configuration. (The agent can go Up and Down as well as Left and Right.)
 - (i) Can a simple reflex agent be perfectly rational for this environment? Justify.
 - (ii) Can a simple reflex agent with a randomized agent function outperform a simple reflex agent? Justify.
- 2A. Consider a state space where the start state is number 1 and the successor function for 3M state n returns two states, numbers 2n and 2n + 1.
 - (i) Draw the portion of the state space for states 1 to 15. Suppose the goal state is 11. List the order in which nodes will be visited for breadth-first search, depth-limited search with limit 3, and iterative deepening search.
 - (ii) Would bidirectional search be appropriate for this problem?
- **2B.** Analyze BFS, DFS and UCS search techniques with four performance measures. **3M**
- 2C. Consider the following graph, run depth first search and iterative deepening tree search with limit upto 2. Initial state is A and goal state is G. Which the two tree search techniques perform better. Clearly show contents of fringe list at each step. Include a node in the fringe only if it is not present at that instant.



3A. Using A* algorithm work out a route from town A to town M. Use the following cost functions: g(n) = The cost of each move as the distance between each town (shown on map). h(n) = The Straight Line Distance between any town and town M (shown on table). Provide the search tree showing the order in which the nodes are expanded and the cost at each node. For each node n, display g(n), h(n) and f(n) separately besides each node. Finally, state the route taken and the cost of that route.



3B. In game playing, what is n ply look ahead? Consider the following state S in a Tic Tac Toe game. Explore the game tree when MAX (marks X) and MIN (marks O) make one move each, with MAX playing at state S. Compute the heuristic values for leaves of this sub game tree. Heuristics for a state is, Number of winning lines open to MAX minus number of winning lines open to MIN. If MAX wins at leaf of subtree then it will be evaluated as +1000, and if MAX loses it will be -1000. Propagate the values back to state S.



3C Show the trace for ALPHA-BETA pruning for the following hypothetical game tree. **4M** The root is MAX node.



Fig. 3C

- 4A. Why predicate logic is better than propositional logic in knowledge representation? 2M With an example explain universal and existential quantifiers.
- **4B.** Consider the following two vocabularies with only four propositions: A, B, C, and D. How many models are there for the following sentences and find out the worlds where all of these sentences are TRUE using truth table? $(A \land B) \lor (C \land D)$

 $A \Leftrightarrow B \Leftrightarrow C$ What do you mean by proof 1

4C. What do you mean by proof by contradiction? The following hypothesis is as **5M** follows.

Either Aditi attended the meeting or Aditi was not invited.

If the boss wanted Aditi at the meeting, then Aditi was invited.

Aditi did not attend the meeting.

If the boss did not want Aditi there, and the boss did not invite Aditi there, then Aditi is going to be fired.

- (i) Represent the above using proper propositional grammar.
- (ii) Prove by resolution that "Aditi is going to be fired".
- 5A. What kinds of environment characteristics lead to uncertainty in an agent? Give an 2M example of uncertain reasoning.
- **5B.** Consider a vocabulary with the following symbols: Politician (x), Person(y), **3M** Barber(x), Man(y) and the following,

Fools(x, y, t): person x fools person y at time t

Shaves(x, y): person x shaves person y

Use the above to write the following assertions in first order logic.

- (i) Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.
- (ii) There is a barber who shaves all men in town who do not shave themselves.
- **5C.** What are semantic networks? Draw a semantic network to illustrate inheritance and **5M** show that it helps in drawing inference.

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