Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

V SEMESTER B.TECH. (INFORMATION TECHNOLOGY / COMPUTER AND COMMUNICATION ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: ARTIFICIAL INTELLIGENCE [ICT 4009]

REVISED CREDIT SYSTEM
(5/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Write the function for a model based reflex agents. With a schematic diagram, explain how it chooses to perform an action using the internal model. **5**

1B. Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers 2n and 2n + 1.

i) Draw the portion of the state space for states 1 to 15.

ii) Suppose the goal state is 13. List the order in which nodes will be visited for depth-limited search with limit 3, and iterative deepening search. **3**

1C. Consider the problem statement "Three missionaries and three cannibals are on one side of the river, along with a boat that can hold one or two people. Find a way to get everyone to the other side, without ever leaving a group of missionaries outnumbered by cannibals".
Give the state description, initial state, goal state, and successor function (operators) for the given statement. Choose a formulation that is precise enough to be implemented. **2**

2A. Write the Python code for Iterative deepening depth-first search which should terminate when a solution is found or if the search returns failure. If a solution exists, return the path to the solution from the root. Also evaluate the algorithms performance. **5**

2B. Give the pseudo code for chronological backtracking algorithm. With **6**-queens problem as a scenario, illustrate how intelligent backtracking reduces the search space by conflict-directed back jumping to that of chronological backtracking. **3**

2C. Suppose KB = $\{(P \wedge Q), (P \Rightarrow R), ((Q \wedge R) \Rightarrow S)\}$. Prove S by inference rules. **2**

3A. Consider a full binary search tree - 4 ply deep. The evaluation/utility values for the terminal nodes (from Left to Right) are 10, 11, 9, 12, 14, 15, 13, 14, 5, 2, 4, 1, 3, 22, 20, 21. Show which are the terminal nodes pruned by Alpha – Beta pruning and what is the value returned by the algorithm. Draw the tree again and apply **5**

minimax procedure for the given problem and show the value returned by minimax algorithm.

3B. Consider a blocks world problem domain. Initially, block A is on the floor, block C is on block A and block B is on floor. The goal state is defined by block C on the floor, block B on block C and block A on block B. Using PDDL represent initial state, goal state and set of action schemas. **3**

3C. With Map Coloring as an example show the inconsistency involved in Forward checking. Resolve this using arc consistency method. **2**

4A. i) Consider the following knowledge base
   a) The humidity is high or the sky is cloudy
   b) If the sky is cloudy then it will rain
   c) If the humidity is high then it is hot
   d) It is not hot
   e) And the goal: it will rain. Find whether the goal is derivable using proof by resolution.

ii) Represent the statement "A biped has two legs attached to a body" in first order logic. **5**

4B. State disjoint, exhaustive decomposition and partition with respect to categories and objects of knowledge representation. With an example, illustrate these concepts. **3**

4C. For the burglary example having the nodes JohnCalls, MaryCalls, Alarm, Burglary and Earthquake, show how "network structure depends on order of introduction of the nodes". Draw the network structure for both the order you have chosen. **2**

5A. i) Obtain the planning graph for the "Birthday Dinner" problem up to level S1. Also show the mutex relations at each levels.
Init: garbage ∧ clean ∧ quiet
Goal: ¬ garbage ∧ dinner ∧ present
Actions :
- Cook
  - Pre: clean
  - Effect: dinner
- Wrap
  - Pre: quiet
  - Effect: present
- Carry
  - Pre: garbage
  - Effect: ¬ garbage ∧ ¬ clean

ii) List and explain the terminating criteria for GRAPHPLAN. **5**

5B. Explain Current-best-hypothesis search. With a schematic diagram show how the consistency is maintained by Current-best-hypothesis search. **3**

5C. What is the drawback of Semantic network notation compared to the first order logic? Propose a method to resolve this issue. Explain with an example. **2**