Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (COMPUTER SCIENCE AND ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2015
SUBJECT: ARTIFICIAL INTELLIGENCE (ELECTIVE-III) (CSE 423)
REVISED CREDIT SYSTEM
DATE: 8-12-2015

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions. Missing data, if any, may be suitably assumed.

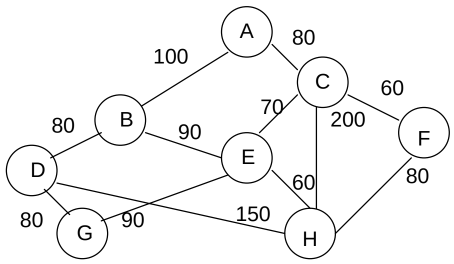
1A. Explain "thinking" rational and "acting" rational approaches. With an example identify the merits of "acting rational" approach over "thinking rational" approach? 3M

1B. Write schematic diagram for the simple reflex and model based reflex agent. What kinds of knowledge are required in order to update the internal state of a model based agent? Explain. 4M

1C. Write pseudo code for the complete process of problem solving agent and comment on the environment characteristics of such an agent. 3M

2A. Consider a graph search problem where for every action, the cost is at least ε, with $\varepsilon > 0$. Under what condition, uniform cost search is guaranteed to return an optimal solution whereas breadth first search is not. Specify conditions for both uniform cost search and breadth first search. 2M

2B. Considering A and H as the source node and goal node respectively find the path using Uniform Cost Search from A to H. Show the result in the form of a table displaying an entry for each iteration of the loop. In the table, display the values under the column named <i> which refers to iteration number starting from 1, <Frontier> and <Explored>. The <Explored> list should be shown as list of edges whereas the <Frontier> list should be shown as list of {<path, cost>} where path is to be listed as the set of edges starting from A and cost is to be displayed as sum of individual costs as well as the final cost. 5M



2C. Find the number of nodes that are generated when b=10, d =5, l= 6, m= 7 during following searches. Explain node generation calculation involved in each kind of search.
i) BFS ii) Depth Limited Search iii) Iterative Deepening Search 3M

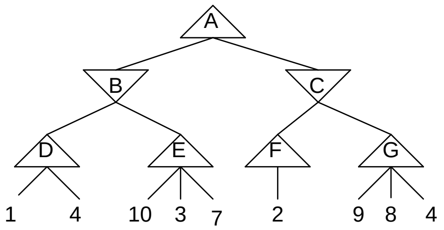
3A. State the condition for an admissible heuristic in A* algorithm. Let h1(s) be an admissible A* heuristic. Let h2(s) = 2*h1(s). State a condition under which A* tree search with h2 is not guaranteed to return the optimal path. 2M

3B. Draw the search tree for solving 8-puzzle with the initial state as {1, 0, 2, 5, 6, 3, 4, 7, 8} and the goal state as {1, 2, 3, 4, 5, 6, 7, 8, 0} . The tiles are shown in the usual order which is row major order and in left to right manner. Clearly show all the intermediate trees generated as part of trace. On all the intermediate trees, show each node as 3*3 cell and display the node evaluation computation separately for each node. Show the action sequence from initial state to the goal state in all of the following.

i) A* search with h1 (number of misplaced tiles) as the heuristic
ii) A* search with h2 (Manhattan distance) as the heuristic. 6M

3C. Suppose the Greedy best first search algorithm is to be applied for the 3(B) problem. Explain what changes are needed in the search tree generation for h1 and search tree generation for h2 heuristics separately. 2M

4A. The following tree represents all possible outcomes of a hypothetical zero-sum game: This tree is from the perspective of the MAX player wherein MAX nodes are denoted by small triangles and MIN nodes by inverted triangles.



i) Show the game tree by computing the back-up values of each node using the Minimax strategy. Mark these values inside a circle near each node.

ii) Show the game tree again by alpha beta pruning algorithm computing the values of alpha and beta at the beginning and at the end of recursive call. Mark alpha and beta values within bracket near each node on the tree and denote it in the form: (α,β). For each node show the alpha-beta values at the end of recursive call below the initial values of alpha-beta.

iii) Show the game tree again by alpha beta pruning algorithm to circle each node that would NOT be considered by the pruning algorithm. (Assume that leaves are considered in left-to-right order). 5M

4B. Consider the following statements about the student interests. *If students like Artificial Intelligence, then they do not like Digital Design. If people do not like Artificial Intelligence, then they like Digital Design and Computer Architecture. If people do not like Digital Design or they like Computer Architecture, then they like Software Design. If people like Software Design, then they like Modeling.*

i) Express the above statements in Propositional logic by choosing first letter of Course name as the propositional symbol for the subject they like. Clearly define the meaning of each proposition.

ii) Convert statements from (i) into Conjunctive Normal Form (CNF). Number the clauses in your Knowledge Base (KB) starting with number 1.

iii) Using resolution algorithm, prove that “students like Modeling” using Knowledge Base by showing pictorially. If “students like Modeling” cannot be proven, then clearly explain or demonstrate why. 5M

5A. Prove the logical equivalence of $\forall$ x P(x) in terms of existential quantifier. Derive the equivalence in terms of basic operators. 3M

5B. For the following sentences in the first-order logic, translate to English sentence and show whether it is valid or unsatisfiable.

i) $\forall$ x, y x = y

ii) $\exists$ *x* x, y x =y 3M

5C. Express the initial state and goal state of the planning problem in the blocks world problem for three blocks labelled A, B and C. Consider the start state as the one in which all blocks are stacked continuously one above another such that A is the topmost block and is on top of B. B is on top of C and C is on table. Goal state is the one in which all blocks are stacked continuously one above another such that C is the topmost block and C is on top of B. B is on top of A and A is on table. Make use of predicates involved in blocks world problem only. Write action schema for move(b, x, y) and move(b, x) and show the action sequences in solving the problem. 4M

6A. Discuss the major factors while designing an agent component by learning from data. Explain with an example. 5M

6B. Identify the challenges and requirements of ontological engineering by distinguishing it from knowledge engineering 3M

6C. Show that a probabilistic agent is basically a logical agent. But in what ways are they different? 2M