Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (INFORMATION TECHNOLOGY/COMPUTER AND COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, APRIL/MAY 2019

SUBJECT: PROGRAM ELECTIVE-II - ARTIFICIAL INTELLIGENCE [ICT 4009]

REVISED CREDIT SYSTEM

(30/04/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Consider the following: 5

If today is Tuesday, I have a test in Mathematics or Economics. If my Economics Professor is sick, I will not have a test in Economics. Today is Tuesday, and my Economics Professor is sick. Therefore, I will have a test in Mathematics.

Show the argument "*I will have a test in Mathematics*" is valid. Use propositional logic and inference rules.

1B. Explain the following with suitable example: 3

i) Conditions for optimality of A* ii) Tautology

1C. Consider a Bayesian belief network with four nodes {A, B, C, D}, where nodes {A, B} represent evidences and {C, D} representing hypotheses. Also, A and B are unconditional nodes and conditional nodes being C and D. Given the following probabilities P(A) =0.3, P(B) = 0.6, P(C|A)=0.4, P(C|~A)=0.2, P(D|A,B)=0.7, P(D|A,~B)=0.4, P(D|~A,B)=0.2, P(D|~A,~B)=0.01. Write the CPTs and also calculate the Joint probability P(A,B,C,D}. 2

2A. Consider the graph in Figure Q.2A. Node A is the start node (indicated with the arrow) and G is the goal (indicated by the double circle). The Table Q.2A(i) gives the heuristic values h(n) for each node, however h(B) is unknown. 5

Table Q.2A(i)

n	*h(n)*
A	5
B	?
C	4
D	3
E	3
F	1
G	0

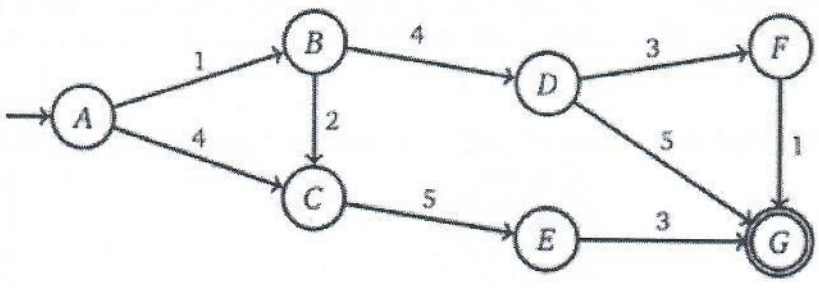

Figure Q.2A

i) Provide the range of values for h(B) for which h would be admissible.

ii) Apply the search strategies listed in the table Table Q.2A(ii) and answer the following:

a) Which of the listed paths are possible?

b) Indicate valid paths by marking an X in the appropriate row(s). Assume that h is admissible in each case. If more than one path is a valid result then mark all such paths.

Table Q.2A(ii)

Search algorithm	A – C – E – G	A – B – C – E – G	A – B – D – G	A – B – D – F – G
Depth first				
Breadth first				
A^* with heuristic h				

2B. Write and explain the forward chaining algorithm for knowledge bases in Horn form. 3

2C. Describe a search space in which Iterative Deepening Search performs much worse than Depth-First Search. 2

3A. Show that the premises "A student in this class has not read the book", and "Everyone in this class passed the first exam" imply the conclusion " Someone who passed the first exam has not read the book" . Use first order logic and inference rules. 5

3B. Consider the game tree in the Figure Q.3B. Calculate the value at the root of the tree using minimax algorithm. Perform alpha beta pruning to show which nodes will be pruned. 3

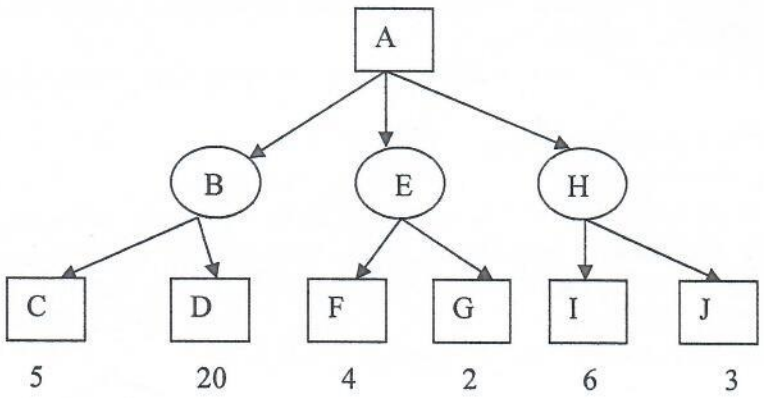

Figure Q.3B

3C. Given the words, the words are required to be put in a sequence, that has a sensible meaning. For example, in English language, the words {fun, exams, term, are, end} can be put together in this valid ordering: "end term exams are fun". As stated, the language used is completely unknown, but an oracle can be used that assigns a score to every sequence introduced, according to how ridiculous it is (for example, in English, the sequence "exams end term" is considered less ridiculous than "term exams end"). If hill climbing is used for the above search space, will it always find a valid sentence? 2

4A. Consider the solved 8-puzzle game given in Figure Q.4A(i) and answer the following questions: 5

Figure Q.4A(i)

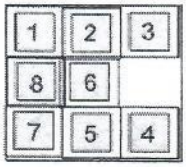

Figure Q.4A(ii)

i. Given a puzzle state like the one in Figure Q.4A(ii), where the numbers are in the wrong

places, search for a series of moves which ends in the solution given in Figure Q.4A(i) . A path cost could be calculated as the number of moves required.

ii. Write a heuristic function, h, for this game (remember that this estimates the path cost from a particular state to the solution).

iii. What is the value of h for the above board state in Figure Q.4A(ii)?

iv. In a greedy search, what move would be chosen next? (i.e., move the 3, the 4 or the 6 into the gap?)

v. Is this heuristic admissible ?

4B. Explain with a suitable diagram a model-based and utility-based agent. 3

4C. Figure Q.4C depicts a search space with the node P as start node and node D as goal node. The nodes are laid out on a grid where each square is of size 10x10 units. Calculate the heuristic value of node J assuming heuristic function to be 2

i) Manhattan distance to the goal state

ii) Euclidean distance to the goal state

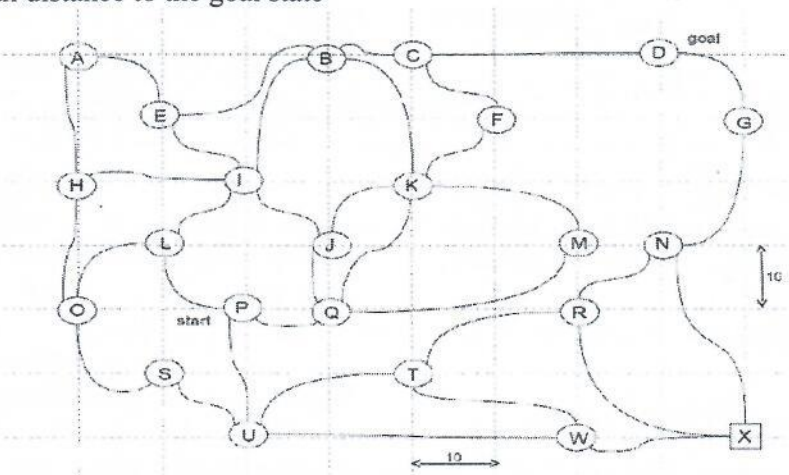

Figure Q.4C

5A. Consider a blocks world problem domain. Initially, block A is on the floor, block C is on block A, and block B is on the floor. The goal state is defined by the block C on the floor, block B on block C and block A on block B, Using PDDL represent the initial state, goal state and set of action schema. 5

5B. Give a PEAS description for the task environment and characterize it in terms of the properties for the following agent type: 3

i. Playing Soccer ii. Shopping for used AI books on internet

5C. Consider the AND-OR graph in Figure Q.5C. Which is the best node to expand next by A* algorithm? 2

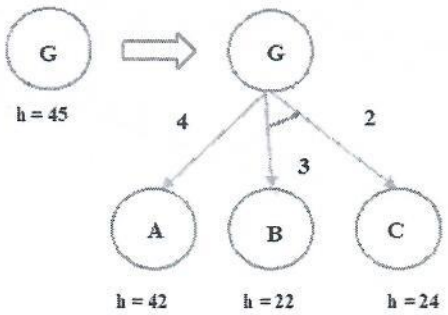

Figure Q.5C