GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2020-2021

ARTIFICIAL INTELLIGENCE

CS701

TIME ALLOTTED: 3 HOURS **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No.
1.	(i)	If b = branching factor and d = depth, then the space complexity of DFS is a) O(bd) b) O(d+b) c) O(b) d) O(d)	1	CO1,3
	(ii)	In case of Simplest Hill Climbing a) 1st closer node is chosen b) All successors are compared & then chosen the closest one c) 2nd node is chosen d) 1st remote node is chosen	1	CO1,3
	(iii)	Uninformed search is also known as a) Best first search b) Hill climbing search c) Worst case search d) d) Blind search	1	CO2
	(iv)	Hill-Climbing algorithm terminates when a) Stopping criterion met b) Global Min/Max is achieved c) No neighbor has higher value d) d) All of the mentioned	1	CO2
	(v)	Resolution can be used for a) Question answering b) Theorem proving c) For both question answering and theorem proving d) None of these	1	CO1,3
	(vi)	In Minimax algorithm search process obeys a) breadth first search fashion b) depth first search fashion c) best first search fashion d) none of these	1	CO2

(vii)	Which of the following is tautology? a) $P \wedge \neg Q$ b) $(P \vee Q) \rightarrow P$ c) $(P \wedge Q) \wedge \neg Q$ d) $(P \wedge Q) \rightarrow P$	1	CO4
(viii)	Horn clause is a clause with positive literals a) At most one b) At most two c) At least one d) d) At most four	1	CO4
(ix)	Which of the following is NOT true about backward chaining? a) Backward chaining is a goal directed reasoning process b) Backward chaining would be much better to use when trying to prove theorems c) For arriving at a new fact, backward chaining is more natural d) d) A medical diagnostic program is a query system that would probably use	1	CO4
(x)	The solution of the problem 'Plateau' is a) Backtracking b) Checking set of rules before using slope Planning c) big jump d) ignoring	1	CO3
(xi)	Which of the following algorithm does not face local maxima problem? a) Simple Hill Climbing b) Steepest Ascent Hill Climbing c) Best First d) None of these	1	CO1,3
(xii)	NLP (with respect to AI) stands for a) Natural Linear Processing b) Natural Language Processing c) Natural Linear Programming d) Natural Language Programming	1	CO4

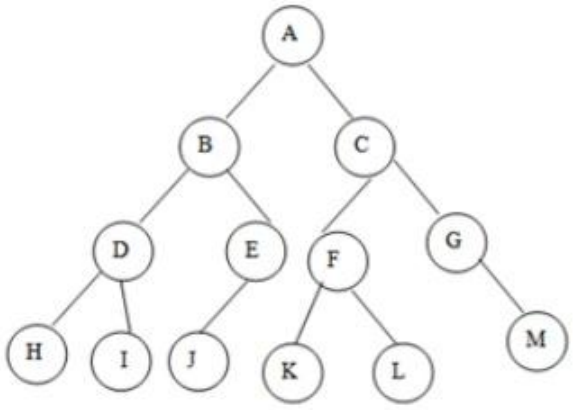
GROUP – B*

(Short Answer Type Questions)

Answer any ***three*** from the following: **3×5=15**

			Marks	CO No.
2.	(a)	Water jug puzzle: A 7- liter jug is filled with water; you are required to measure all seven volumes from 1L to 7L. There are two empty jugs of size 5 and 2 liters. There is no other way of measuring water except by the size of the jugs, i.e., one can either empty a jug into another or fill another jug to its brim. There is no other source of water. Model this puzzle as a state-space search problem. A state is represented by a tuple (A,B,C), where A is the amount of water in the 7L jug, B is the amount of water in the 5L jug and C is the amount of water in the 2L jug. The initial state is (7,0,0). A state-space expresses all valid states and their transitions. Draw the entire state-space consisting all possible next states, such that all seven volumes from 1L to 7L can be measured.	5	CO2

3.	(a)	Write a program in PROLOG to find factorial of '*n*', where *n* is positive integer number.	5	CO5
4.	(a)	What is FOPL? Represent the following sentences by FOPL. i. All students are smart. ii. Every student loves some other student. iii. Mary likes all types of food. iv. Every student who takes Networking also takes Graphics. v. All kings who are greedy are Evil.	5	CO4
5.	(a)	What is converse, inverse and contrapositive of following statement? "If you have my home key then you can unlock my home"	3	CO4
	(b)	Is p −> q a Horn Clause? Justify your answer.	2	CO3
6.	(a)	What are the differences between BFS and DFS? Consider the following graph and apply DFS algorithm to search 'K'.	5	CO2



GROUP – C*
(Long Answer Type Questions)

Answer any ***three*** from the following: **3×15=45**

			Marks	**CO No.**
7.	(a)	How do you evaluate any search technique?	5	CO2
7.	(b)	Under what condition is breadth-first search optimal?	2	CO2
7.	(c)	Compare Hill-Climbing and Best First-Search.	3	CO3
7.	(d)	Write down the disadvantages of hill climbing search procedure.	5	CO2
8.	(a)	Consider the 3-puzzle problem shown in following figure:	7	CO2

	3
1	2

Initial

1	3
2	

Goal

Possible operators (in order) are: up, down, left, right; Assume that repeated states are not detected.
Draw the search tree using breadth first search.

8	(b)	Would depth first search find the goal? Explain.	4	CO2
8	(c)	How many nodes would be generated if Iterative Deepening is used starting with depth increment one?	4	CO2
9.	(a)	Given two jugs with no measuring marking on them, a 4-gallon jug and a 3-gallon jug. There is a pump to fill the jug with water. How do you get exactly 2 gallons of water in the 4-gallon jug? Give the state space for the problem. Describe the production rules and provide a possible solution with the help of a state space graph.	8	CO2
9	(b)	Solve this water-jug problem by A* algorithm. Use the Euclidean distance of a node (x, y) from a fixed node (2, 2), i.e., $h = [(x-2)^2+(y-2)^2]^{1/2}$ as a heuristic function.	7	CO2
10.	(a)	Consider the following game tree in which static scores are all from first player's point of view. Which would be his best first move if MINIMAX algorithm is used? Which branches will be pruned if α-β pruning algorithm is used?	10	CO2

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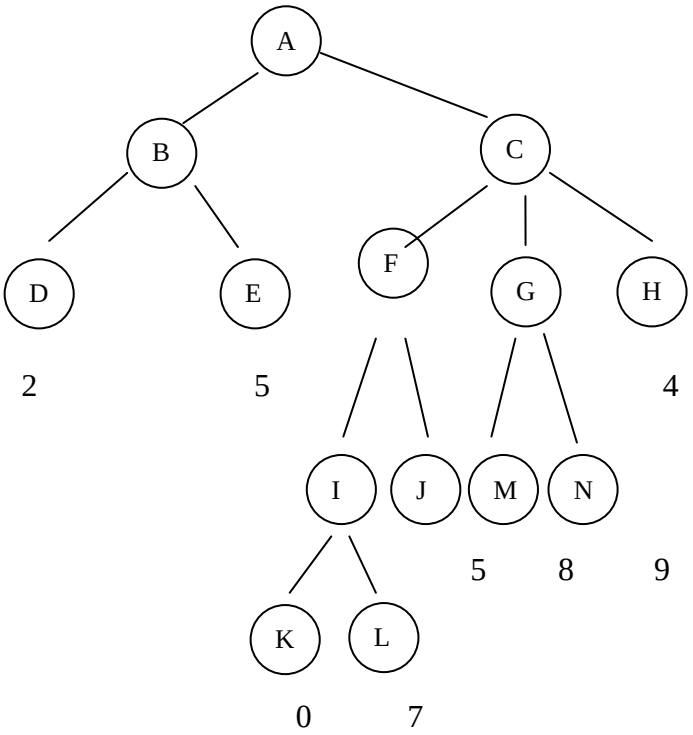

10.	(b)	Consider the following arrangement and solve the problem using A* search. Define the state space. Write the operations, define the heuristic and show the solution.	5	CO2

Initial state:

8	2	3
1	6	4
7		5

Final State:

1	2	3
8		4
7	6	5

11.	(a)	What do you mean by Modus Ponens inference rule? How is it different from Modus Tollens? Explain with examples	5	CO4
11.	(b)	Following statements are given: 1. Marcus was a man. 2. Marcus was Pompeian. 3. All Pompeians were Romans. 4. Caeser was a Rular.	10	CO3

5. All Romans were either loyal to Ceaser or hated him.
6. Everyone is loyal to someone.
7. People only try to assassinate rulers they are not loyal to.
8. Marcus tried to assassinate Caeser.

From above statements, using First Order Predicate Logic and rules of inference, prove that "Marcus hated Caeser".