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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E.   **Semester: V**
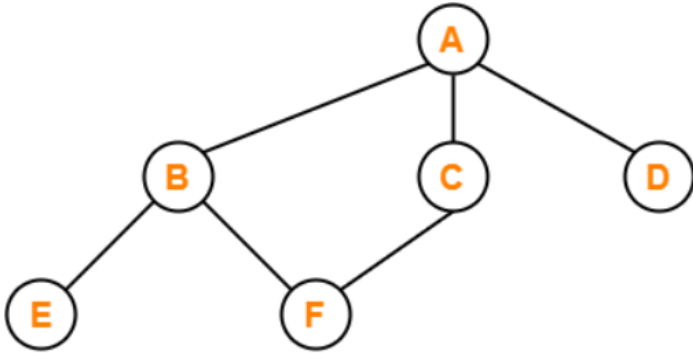
Branch: Computer Science and Engineering   **Duration: 3 hrs.**

Course Code: 23CS5PCAIN / 22CS5PCAIN / 20CS5PCAIP   **Max Marks: 100**

Course: Artificial Intelligence

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
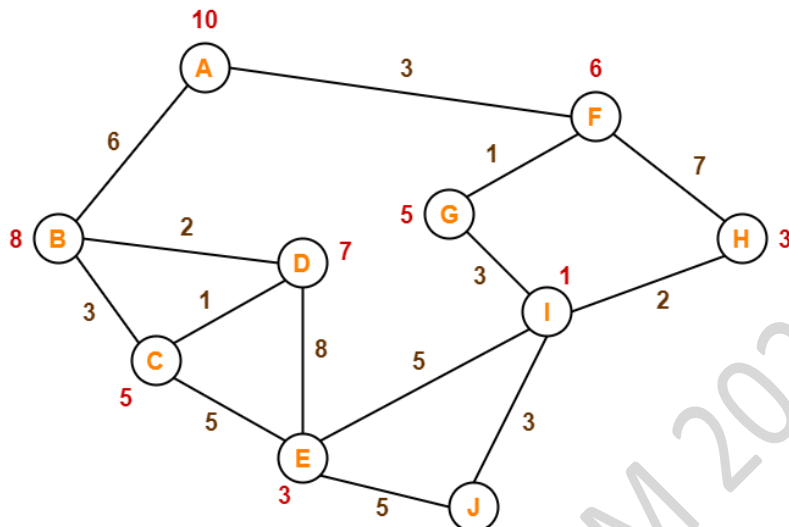2. Missing data, if any, may be suitably assumed.

			UNIT - I	CO	PO	Marks
1	a)		Explain four categories of definition of AI with the example.	CO1	PO1	**10**
	b)		List and explain the types of an environment with the examples.	CO1	PO1	**10**
			OR			
2	a)		Describe the vacuum cleaner world problem with the suitable diagram.	CO1	PO1	**10**
	b)		With the diagram explain the following agents: • Model-based agent • Goal-based agent	CO1	PO1	**10**
			UNIT - II			
3	a)		Apply Depth First Search (DFS) algorithm for the given graph. Find the optimal path. 	CO1	PO1	**10**
	b)		Write Breadth First Search (BFS) algorithm. Justify whether BFS is Optimal and Complete. Compare Time and Space complexity of BFS with Uniform Cost search in terms of Branching factor (b) and Depth (d).	CO1	PO1	**10**

| 4	a)	Demonstrate working of A* search algorithm for the following graph given below. The numbers written on edges represent the distance between the nodes. The numbers written on nodes represent the heuristic value. Illustrate each step clearly by showing the f(n) calculation. Write the final optimal path obtained. Consider start state as A.	CO1	PO1	10

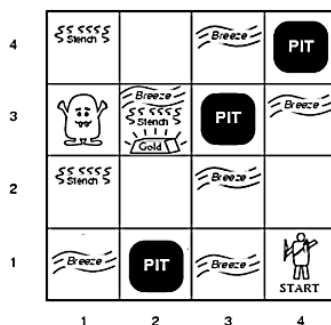|	b)	Apply the Greedy best first search to find the optimal path from start state to goal state. Write all steps as well as open and closed lists. Consider start node as S.	CO1	PO1	10
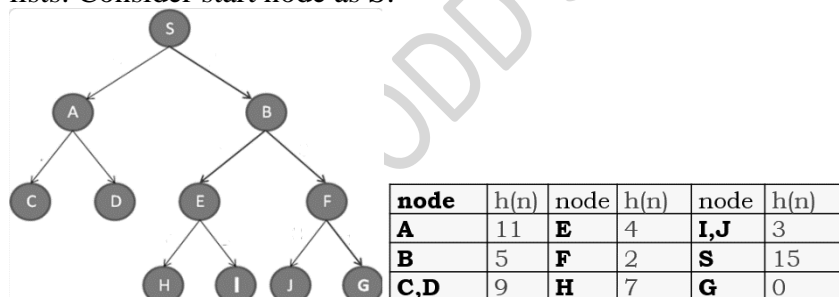
node	h(n)	node	h(n)	node	h(n)
A	11	**E**	4	**I,J**	3
B	5	**F**	2	**S**	15
C,D	9	**H**	7	**G**	0

UNIT - III

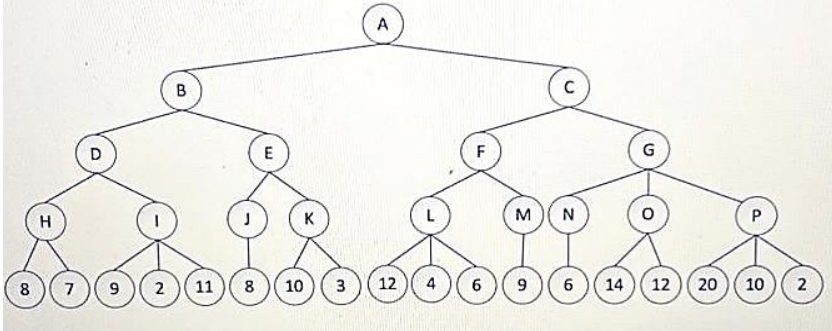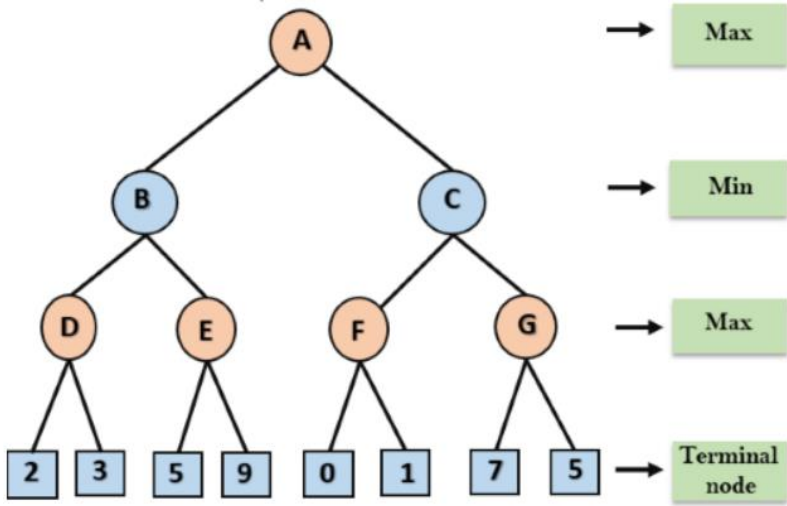| 5	a)	With the architecture diagram, explain Knowledge-based agent Given the below snapshot, use model checking to validate that location [3,1] is safe. Considering only Pit, list all the models of KB and α. Justify why KB entails $\neg P_{3,1}$	CO1	PO1	10

	b)	Consider S and T as variables and the following relation representing the relationships:	CO1	PO1	5

		(i) a: ¬(SVT) (ii) b: (S ∧ T) (iii) c: T V ¬T Analyze the following using truth table approach and show whether i) a entails b ii) a entails c			
	c)	Using propositional logic, prove (S) from (P ∧ Q ; P => R ; (Q ∧ R) => **S**). Show in detail the solution steps.	CO1	PO1	**5**
		OR			
6	a)	**I.** Design the First-order logical (FOL) representations for the following sentences. i. Every real number has its corresponding negative ii. Everybody loves somebody iii. There is somebody whom no one loves. iv. Susan brought everything that Ronald bought v. Parrot is green while the rabbit is not **II.** Find a most general unifier for the set **i.** W = {P (a, x, f (g(y))), P (z, f (z), f (u))} ii. W = {Q (f (a), g(x)), Q (y, y)}	CO2	PO2	**10**
	b)	Consider the following English statements. 1.If someone suffers from allergies, then she/he sneezes. 2.If someone lives with a cat and is allergic to cat, then she/he will suffer from allergies. 3. Tom is a cat. 4. Mary is allergic to cats. Represent above sentences in FOL and prove by FOL resolution "Mary sneezes."	CO3	PO3	**10**
		UNIT - IV			
7	a)	Convert the following statements into FOL statements and prove the following statement using both forward and backward chaining. John likes all kinds of food. Apples are food. Chicken is food. Anything anyone eats and isn't killed by is food. Bill eats peanuts and is still alive. Sue eats everything Bill eats. To prove "**John likes peanuts**"	CO33	PO3	**10**

				CO1	PO1	10
	b)	Explain the steps of Unification algorithm.		CO1	PO1	10

<div align="center">OR</div>

				CO1	PO1	10
8	a)	Use the Minimax algorithm to compute the minimax value at each node for the game tree below with step by step calculations. Assuming root node as MAX node. Write the Minimax algorithm.		CO1	PO1	10

				CO1	PO1	10
	b)	Apply Alpha-beta tree search algorithm for the given graph. Write the alpha-beta algorithm		CO1	PO1	10

<div align="center">UNIT - V</div>

				CO1	PO1	10
9	a)	Given the full joint distribution shown below, calculate the following		CO1	PO1	10

a) *P(toothache)*
b) *P(cavity)*
c) *P(toothache | cavity)*
d) *P(cavity | toothache ∨ catch)*

	toothache		¬toothache	
	catch	¬catch	catch	¬catch
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

				CO1	PO1	5
	b)	A bag I contains 4 white and 6 black balls while another Bag II contains 4 white and 3 black balls. One ball is drawn at random from one of the bags, and it is found to be black. Find the probability that it was drawn from Bag I		CO1	PO1	5

				CO1	PO1	**5**
		c)	What is the probability that the alarm has sounded but neither a burglary nor an earthquake has occurred, and both John and Merry call?			

B	E	P(A|B,E)
T	T	.95
T	F	.94
F	T	.29
F	F	.001

A	P(J|A)
T	.90
F	.05

A	P(M|A)
T	.70
F	.01

P(B) = .001

P(E) = .002

OR

10	a)	We have a bag of three biased coins a,b, and c with probabilities of coming up heads of 20%, 60%, and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes X1, X2, and X3.	CO1	PO1	**10**

    a. Draw the Bayesian network corresponding to this setup and define the necessary CPTs.
    b. Calculate which coin was likely to have been drawn from the bag if the observed flips come out heads twice and tails once.

	b)		CO4	PO4	**10**

P(B = bad) = 0.1

P(F = empty) = 0.2

P(G = empty I B = good, F = not empty) = 0.1
P(G = empty I B = good, F = empty) = 0.8
P(G = empty I B = bad, F = not empty) = 0.2
P(G = empty I B = bad, F = empty) = 0.9

P(S = no I B = good, F = not empty) = 0.1
P(S = no I B = good, F = empty) = 0.8
P(S = no I B = bad, F = not empty) = 0.9
P(S = no I B = bad, F = empty) = 1.0

Calculate
1. P(B=good, F=empty, G=empty, S=Yes)
2. P(B=bad, F=empty, G=not empty, S=No)
3. Given the battery is bad, Compute the probability that the car will start

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