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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

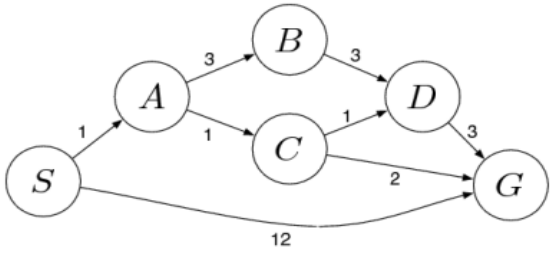
Programme: B.E. **Semester: IV**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

Course Code: 24AM4PCIAI **Max Marks: 100**

Course: Introduction to 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)	Provide the PEAS description for the task environment associated with each of the following agents: i. Satellite image processing system ii. Medical diagnosis system iii. Knitting robot that knits a sweater	*1*	*1*	**6**
	b)	Write a pseudocode for the model-based reflex agents with a suitable block diagram.	*1*	*1*	**6**
	c)	Consider a delivery company tasked with transporting packages to various destinations, across a city with multiple routes of varying distances and costs. The company wants to minimize transportation costs while ensuring timely deliveries. i. Write Uniform Cost Search (UCS) Algorithm. ii. Find the optimal path to reach the delivery goal (G) from the starting point (S) from the graph as shown in Figure 1c.  Figure 1c	*1*	*2*	**8**
		UNIT - II			
2	a)	How can the 8-queens problem be formulated using incremental and complete-state approaches?	*1*	*1*	**4**
	b)	Highlight the limitations of the Hill climbing algorithm in the optimization problem.	*1*	*1*	**6**
	c)	Use Constraint Satisfaction Problem (CSP) technique to find the solution for the following problem:	*1*	*2*	**10**

			LETS + WAVE LATER			
			OR			
3	a)		Explain Heuristic function. Choose an appropriate heuristic function for the following problems: i. 8-puzzle problem. ii. Supermarket with many check-out counters. iii. Shortest path from a source to a destination city in network of cities connected by roads.	*1*	*1*	**5**
	b)		Elaborate on Generate and Test method in an informed search strategy.	*1*	*1*	**5**
	c)		Write the A* search algorithm. Determine the shortest path from the initial state A to the goal state J in the graph depicted in Figure 3c. The heuristic values from each node to the goal node J are provided in the below table.	*1*	*2*	**10**
			UNIT - III			
4	a)		Formulate De Morgan's and Distributive laws with suitable examples.	*2*	*1*	**4**
	b)		Prove the equivalence for the given propositions using Standard Logical Equations. **(p →q) ∧[(~ q∧ (r ∨ ~q)] ⟨=⟩ ~ (q ∨ p)**	*2*	*2*	**6**
	c)		Consider a propositional language where: A =“Angelo comes to the party” B =“Bruno comes to the party” C =“Carlo comes to the party” D =“Davide comes to the party”. Convert the following sentences into propositional logic: i. “If Davide comes to the party, then Bruno and Carlo come too”	*2*	*2*	**10**

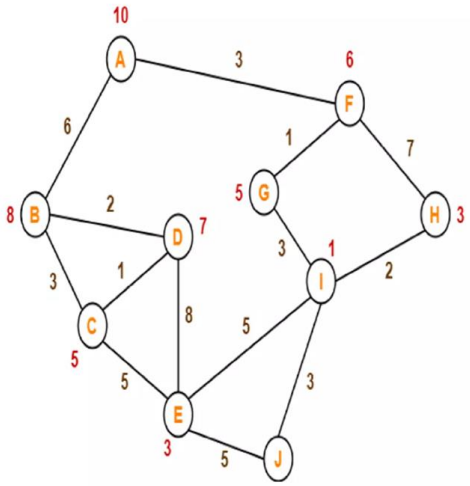
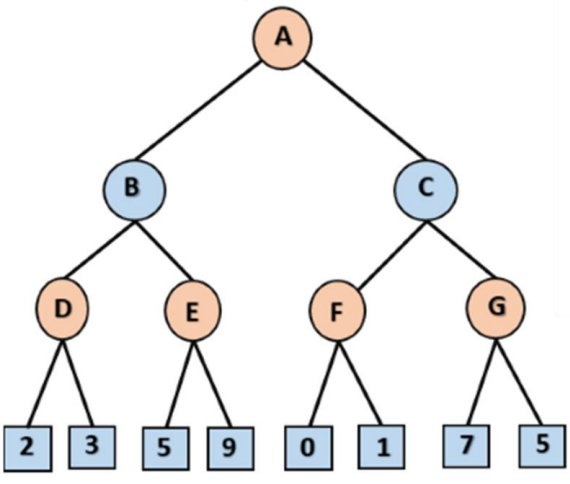
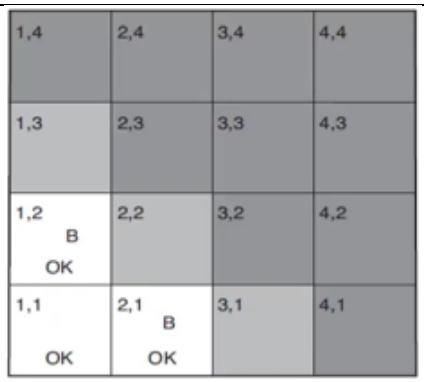


Figure 3c

Nodes	A	B	C	D	E	F	G	H	I
Heuristic Values	10	8	5	7	3	6	5	3	1

			ii. "Carlo comes to the party only if Angelo and Bruno do not come" iii. "Davide comes to the party if and only if Carlo comes and Angelo doesn't come" iv. "If Davide comes to the party, then, if Carlo doesn't come then Angelo comes" v. "Carlo comes to the party provided that Davide doesn't come, but, if Davide comes, then Bruno doesn't come"			
			OR			
	5	a)	Comprehend the types of quantifiers in First-Order Logic.	*2*	*1*	**4**
		b)	Transform the given complex proposition into Conjunctive Normal Form (CNF). i. $\neg((A \vee B) \implies (C \wedge D))$ ii. A ⇔ (B ∨ E)	*2*	*2*	**6**
		c)	Consider the following Knowledge Base: i. Anyone whom Mary loves is a football star. ii. Any student who does not pass does not play. iii. John is a student. iv. Any student who does not study does not pass. v. Anyone who does not play is not a football star. Convert the statements into First Order Predicate Logic and prove using Resolution theorem, "If John does not study, then Mary does not love John".	*2*	*2*	**10**
			UNIT - IV			
	6	a)	Describe uncertain knowledge in Artificial Intelligence.	*2*	*1*	**4**
		b)	Solve the graph depicted in Figure 6b using Alpha-Beta pruning and indicate the pruned nodes.  Figure 6b	*2*	*2*	**6**
		c)	In Wumpus World Problem, an agent is exploring a 4x4 grid cave. The agent starts at position [1,1] as shown in the Figure 6c. Calculate the probability that each of the three grids [1,3], [2,2], [3,1] contains a pit in the Wumpus world problem.	*2*	*2*	**10**

			 Figure 6c			
			UNIT - V			
	7	a)	Outline the key components of an expert system with a neat diagram.	*3*	*1*	**7**
		b)	What are the key benefits of using expert systems in decision-making processes?	*3*	*1*	**3**
		c)	Rahul is a healthcare Information Technology (IT) specialist tasked with implementing an expert system for diagnosing bacterial infections. i. Identify a suitable expert system and discuss its architecture. ii. Outline the strengths and limitations of the expert system for the defined problem.	*3*	*1*	**10**

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