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

Autonomous Institute Affiliated to VTU

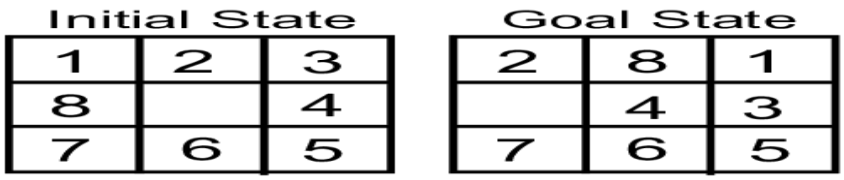
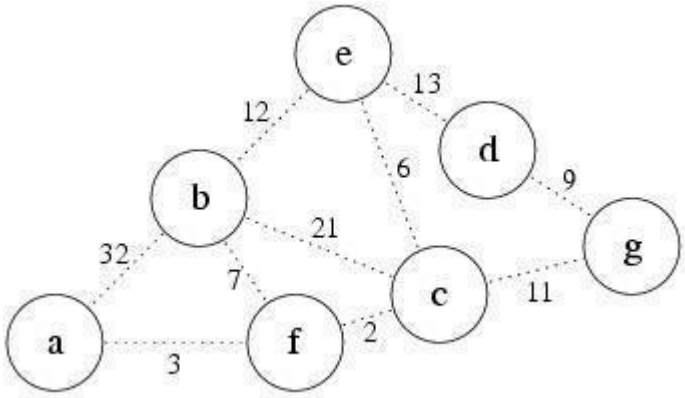
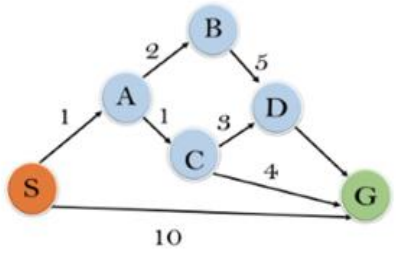
September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 22CS5PCAIN **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.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Illustrate Artificial Intelligence from the aspect of "Thinking Rationally" approach. List its drawbacks. Explain how it is overcome in "Acting Rationally" approach.	*CO1*	*PO1*	**06**
	b)	Demonstrate with a neat diagram a model-based- goal-based agent. Write pseudocode agent program for the same.	*CO1*	*PO1*	**06**
	c)	Formulate the problem for the following scenarios making only those distinctions necessary **to** ensure a valid solution for the following scenarios a. You have a program that outputs the message "illegal input record" when fed a certain file of input records. You know that processing of each record is independent of the other records. You want to discover what record is illegal. b. The missionaries and cannibals problem is usually stated as follows: Three missionaries and three cannibals are on one side of a river, along with a boat that can hold one or two people. Find a way to get everyone to the other side without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place	*CO1*	*PO1*	**08**
		OR			
2	a)	You are asked to develop an agent which gives the direction of any location in a park. The visitor must enter the location and the agent will guide by providing path from current location to the location entered by the visitor. Examine the appropriate agent type suitable for this scenario with a schematic diagram.	*CO1*	*PO1*	**06**

		b)	Write the PEAS description and Environment types for the following agents. i. Vacuum Cleaner agent ii. Medical diagnosis system	*CO1*	*PO1*	**06**
		c)	Formulate the problem for the following scenarios and mention its state space diagram. i. The 8-puzzle problem to solve the given problem below  ii. 8 queens' problem with incremental formulation	*CO1*	*PO1*	**08**
			UNIT - II			
	3	a)	Explain the importance of local search algorithm along with its state-space landscape with a neat diagram.	*CO2*	*PO2*	**06**
		b)	Identify the data structure used to implement uniform cost search. Analyze the graph given and apply uniform cost search algorithm to find the minimum cost. Show step by step graph traversal.  	*CO2*	*PO2*	**06**
		c)	Traverse the graph using A* algorithm and find the optimal path from S to G. Comment on the optimality and complexity of the algorithm. Calculate the Time and Space complexity of the same.  	State	h(n)
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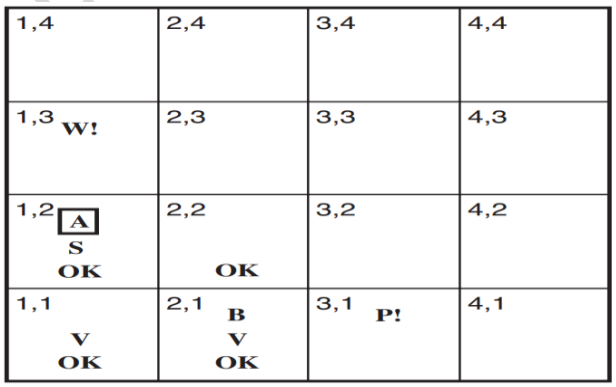
S	5
A	3
B	4
C	2
D	6
G	0		*CO2*	*PO2*	**08**

			UNIT - III			
	4	a)	Convert the following set of sentences to CNF S1: A ⇔ (B ∨ E). S2: E ⇒ D. S3: C ∧ F ⇒ ¬B. S4: E ⇒ B. S5: B ⇒ F. S6: B ⇒ C	*CO3*	*PO3*	**06**
		b)	Let x,y and z be: x: Robert is a policeman y: Robert is a footballer z: Robert has big feet. The Knowledge Base contains the facts: • Robert is either a policeman or a footballer. • If he is a policeman, then he has big feet. • Robert has not got big feet. Perform the following. i. Represent these facts in prepositional logic. ii. If the query "Is Robert a footballer?", use the truth table approach to show whether the query is entitled by the Knowledge Base	*CO3*	*PO3*	**06**
		c)	Illustrate Backus-Naur Form grammar of sentences in propositional logic along with operator precedence. Suppose the agent has progressed to the point shown in the figure having perceived nothing in [1,1], a breeze in [2,1], and a stench in [1,2], and is now concerned with the contents of [1,3], [2,2], and [3,1]. Each of these can contain a pit, and at most one can contain a wumpus. Design the worlds in which the KB is true and those in which each of the following sentences is true: α2 = "There is no pit in [2,2]." α3 = "There is a wumpus in [1,3]." Hence show that KB |= α2 and KB |= α3. 	*CO3*	*PO3*	**08**
			OR			
	5	a)	Point out the syntactic elements of first order logic. Differentiate between the Universal instantiation and Existential instantiation.	*CO3*	*PO3*	**06**
		b)	Consider a vocabulary with the following symbols: Occupation(p, o): Predicate. Person p has occupation o.	*CO3*	*PO3*	**06**

			Customer (p1, p2): Predicate. Person p1 is a customer of person p2. Boss(p1, p2): Predicate. Person p1 is a boss of person p2. Doctor , Surgeon, Lawyer , Actor : Constants denoting occupations. Emily, Joe: Constants denoting people. Use these symbols to write the following assertions in first-order logic: i. Emily is either a surgeon or a lawyer. ii. Joe is an actor, but he also holds another job. iii. All surgeons are doctors. iv. Joe does not have a lawyer (i.e., is not a customer of any lawyer). v. Emily has a boss who is a lawyer. vi. There exists a lawyer all of whose customers are doctor			
	c)	Consider the following set of prepositions. "P or Q", "P implies R" and "Q implies R". Conclude R from these three axioms using resolution algorithm. Show step by step process	*CO3*	*PO3*	**08**
		UNIT - IV			
6	a)	List out the condition for unification. Consider the following statements. (i) If it is a pleasant day you will do strawberry picking (ii) If you are doing strawberry picking you are happy. Prove that "If it is a pleasant day you are happy." Draw the graph	*CO3*	*PO3*	**06**
	b)	Suppose a new pet, Fritz, is delivered in an opaque box along with two facts about Fritz: • Fritz croaks • Fritz eats flies The goal is to decide whether Fritz is green, based on a rule base containing the following four rules: i. If X croaks and X eats flies – Then X is a frog ii. If X chirps and X sings – Then X is a canary iii. If X is a frog – Then X is green iv. If X is a canary – Then X is yellow Apply backward chaining to infer the goal.	*CO3*	*PO3*	**06**
	c)	Consider the following set of sentences i. Marcus was a man. ii. Marcus was a Roman. iii. All men are people. iv. Caesar was a ruler. v. All Romans were either loyal to Caesar or hated him (or both). vi. Everyone is loyal to someone. vii. People only try to assassinate rulers they are not loyal to. viii. Marcus tried to assassinate Caesar. Resolve the query" Who hated Caesar?" by applying forward chaining technique and deriving appropriate substitution set. Follow the necessary steps.	*CO3*	*PO3*	**08**

			UNIT - V			
	7	a)	Given the full joint distribution shown in figure, calculate the following: i. P(toothache) . ii. P(Cavity) . iii. P(Toothache | cavity) . iv. 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	*CO3*	*PO3*	**06**
		b)	A desk lamp produced by The Luminar Company was found to be defective (D). There are three factories (A,B,C) where such desk lamps are manufactured. A Quality Control Manager (QCM) is responsible for investigating the source of found defects. This is what the QCM knows about the company's desk lamp production and the possible source of defects: Factory / % of total production / Prob. Defective lamps A / 0.35 / 0.015 B / 0.35 / 0.010 C / 0.30 / 0.020 Which factory A,B or C has the highest conditional probability of producing a defective lamp.	*CO3*	*PO3*	**06**
		c)	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. i. Draw the Bayesian network corresponding to this setup and define the necessary Conditional probability tables (CPTs). ii. Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once.	*CO3*	*PO3*	**08**

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