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2

Roll Number:	
Thapar Institute of Engineering and Technology, Patiala	
Computer Science and Engineering Department	
BE(3rd Year) Feb 10, 2021 *EST*	UCS411: Artificial Intelligence
Time: 2 Hours	Marks:50
Instructors: Dr. Singara Singh Kasana, Dr. Sukhnandan Kaur	

Note: Attempt any 5 questions. All parts of a question must be answered in order.

Q1	(a) Consider the following statements "Walton is a university having CSED, ECED and MED departments. Jay works in CSED. CSED is located in L Block. He is a professor. Every professor engages lectures and has Ph.D. qualification. Jay's area of interest is AI." (i) Draw the semantic network to represent the knowledge given in the above statements (ii) Represent the same knowledge using frames. (b) Represent the following using conceptual dependency (i) Sue was listening the music in balcony on Sunday. (ii) Dane gave documents to Nick.	[6] [4]
Q2.	(a) There are three hypotheses whose probabilities are given below: $P(H_1) = 0.40$; $P(H_2) = 0.35$; $P(H_3) = 0.25$. Suppose there are three evidences E_1, E_2 and E_3 which can cause these hypotheses to be true. The conditional probabilities are given below. $P(E_1\|H_1) = 0.3$; $P(E_1\|H_2) = 0.4$; $P(E_1\|H_3) = 0.5$; $P(E_2\|H_1) = 0.9$; $P(E_2\|H_2) = 0.6$; $P(E_2\|H_3) = 0.7$; $P(E_3\|H_1) = 0.6$; $P(E_3\|H_2) = 0.3$; $P(E_3\|H_3) = 0.9$; Calculate the posterior probabilities for all three hypotheses when E_3 has occurred. (b) Consider the problem of devising a plan for the given scenario (Initial and Goal states given below) where John wants to prepare for AI exam and for that he needs Notebook and Book of AI. Initial State: Goal State:	[5] [5]

Initial State:

Lawn JOHN IS HERE	Room 1 Notebook _AI Book _DBMS
Study Room	Room C Book_AI

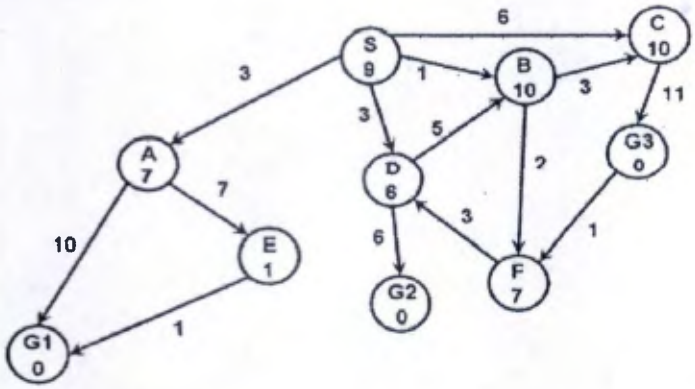
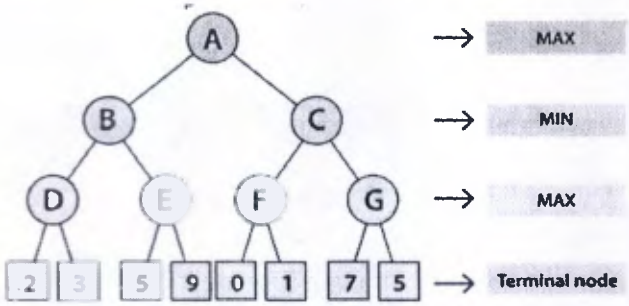
Goal State:

Lawn	Room 1
Study Room JOHN is here with Notebook_AI and Book_AI on table	Room C Book_DBMS

P.T.O.

	Write a set of STRIPS style operators for the given scenario, with minimum number of steps, by using following constraints: i. John can visit Room 1 by passing through lawn. ii. John can visit Room C by passing through Room 1. iii. John can visit Study Room by passing through Room C. iv. John cannot visit back the immediately visited Room. Also mention minimum number of steps required to solve the above problem.	
Q3	(a) Assume that John searches the web for AI topic- *Learning Agents*. The search engine returns 30 pages on that topic out of which only 20 are relevant while does not return 40 additional relevant pages. Find the precision, recall and F measure for this scenario. (b) Explain the components which are used in the design of an Expert System. (c) If you want to design an AI based Expert System for the Crop Management purpose. What possible alternatives you can use to develop such system.	[3] [5] [2]
Q4	(a) Discuss the basic principle of KNN. In prediction step, how it is different than other machine learning models? (b) Build a Decision Tree model using Information Gain for below given data set by taking *Expensive* as output feature. Make the assumption if any. Show all intermediate steps.	[3] [7]

Size	Color	Shape	Weight	Expensive
Big	Black	Square	Heavy	Yes
Small	Blue	Triangle	Light	Yes
Small	Blue	Square	Light	No
Big	Green	Triangle	Heavy	No
Big	Blue	Square	Light	No
Big	Green	Square	Heavy	Yes
Small	Black	Triangle	Light	Yes

Q5	(a) Consider the search graph given below, where S is the start node and G1, G2, and G3 are goal states. Arcs are labelled with the cost of traversing them and the heuristic cost to a goal is shown inside the nodes. Indicate which of the goal states is reached first with Uniform Cost Search algorithm.  Note: Arrange the nodes alphabetically in case nodes have same evaluation function value. Write the contents of OPEN and CLOSED lists at each step. (b) On which principles A* algorithm works? Write the steps of A* algorithm.	[5] [5]
Q6	(a) On which principle, Hill Climbing algorithms work? Write the steps of Steepest Hill Climbing algorithm. (b) Apply alpha beta pruning on the following tree by showing all intermediate values.  	[5] [5]
Q7	(a) Discuss the following in brief, with example (i) Incf and decf operators of LISP (ii) Cut predicate in Prolog. (iii) Trace predicate in Prolog (b) Discuss the following types of AI environments: (i) Fully Observable and Partially Observable (ii) Deterministic and Stochastic (iii) Single agent and multi agent (iv) Static and Dynamic (v) Discrete and Continuous	[5] [5]

All the Best