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**Question Paper Code:U4E02**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Second Semester

Artificial Intelligence & Data Science

21UAD402- ARTIFICIAL INTELLIGENCE

(Regulations 2021)

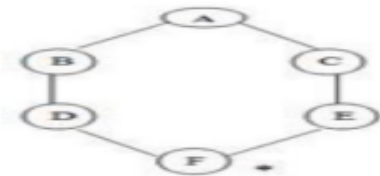
Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (5 x 5 = 25 Marks)

1. Explain the laws of thought approach to think rationally and describe the rational agent approach to act rationally. CO1-U
2. Apply the breadth first search algorithm to construct the breadth first search tree for the following graph CO2-App



3. Explain the semantics of Bayesian Network with an example. CO1-U
4. Differentiate Value iteration and policy iteration. CO1-U
5. Why is temporal difference (TD) learning of Q-values (Q-learning) superior to TD learning of values? Justify your answer CO3-ANA

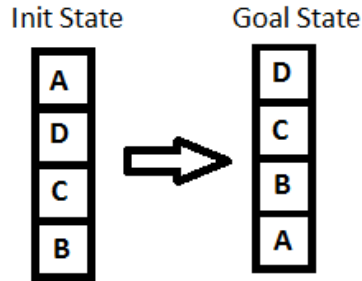
PART – B (5 x 15= 75 Marks)

- 6 (a) (i) Draw and describe the architecture of goal based agent. CO1- U (8)  
(ii) List the different properties of task environment. Give the suitable example for each properties CO1- U (7)

Or

- (b) Discuss about the various kinds of agents and their properties with neat diagram? CO1 U (15)

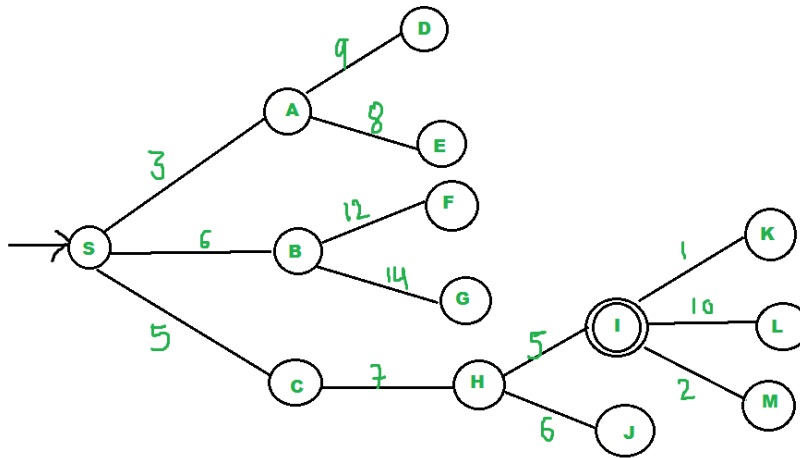
- 7 (a) Consider the blocks world problem with four blocks A,B,C and D CO2-App (15)  
with the start and goal states given below.



Assume the following two operations: Pick and a block and put it on table, pick up a block and put it on another block. Solve the above problem using Hill climbing algorithm and a suitable heuristic function. Show the intermediate decisions and states

Or

- (b) Consider the graph given in figure below. Assume that the initial state is S and goal state is I. Find a path from the initial state to the goal state using Best First Search. Also report the solution cost. CO2-App (15)



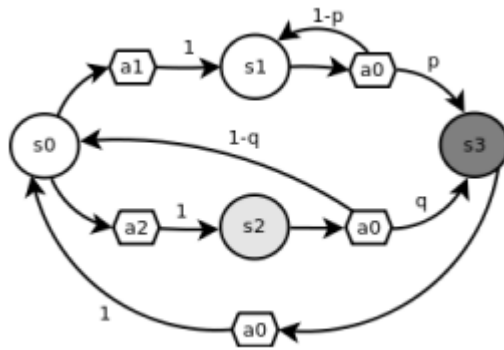
- 8 (a) Explain with example Baye's Belief network and simple inference in belief network CO2-App (15)

Or

- (b) Explain hidden markov models in detail. CO2-App (15)

9 (a) Consider the below figure

CO2-App (15)



States are represented by circles and actions by hexagons. The numbers on the arrows from actions to states represent the transition probability, for instance,  $P(s_3|s_2, a_0) = q$ . Not shown are arrows for actions that have transition probability 0, for instance,  $P(s_0|s_0, a_0) = 0$ . Each of the parameters  $p$  and  $q$  are in the interval  $[0, 1]$ . The reward is 10 for state  $s_3$ , 1 for state  $s_2$  and 0 otherwise. For this question, consider the infinite-horizon MDP  $M$  represented by Figure with discount factor  $\gamma \in [0, 1)$ .

List all the possible policies for  $M$

Show the equation representing the optimal value function for each state of  $M$ , i.e.  $V^*(s_0), V^*(s_1), V^*(s_2)$  and  $V^*(s_3)$ .

Is there a value for  $p$  such that for all  $\gamma \in [0, 1)$  and  $q \in [0, 1]$ ,  $\pi^*(s_0) = a_2$ ? Explain.

Or

(b) Implement the value iteration algorithm for 4x3 grid world.

CO2-App (15)

10. (a) Explain in detail about Adaptive learning with example

CO1- U (15)

Or

(b) Explain in detail about Q learning with example.

CO1- U (15)

