

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY
 End-Term Examination, December 2025
 B.Tech. Semester V

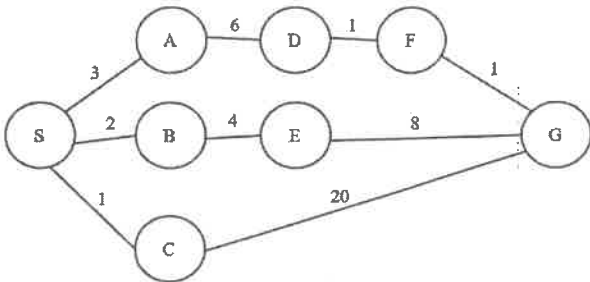
Roll No.....

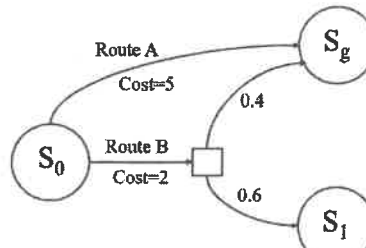
CS1224: Artificial Intelligence

Time: 3 hours

Max. Marks: 35

- Answer All.

Q1.1.	Consider the following graph where each edge is labeled with its cost. The agent starts at node S and wants to reach the goal node G. The straight-line distances (SLD) to the goal are given as heuristic values $h(n)$:  <u>straight-line distances</u> $h(S-G)=10$ $h(A-G)=7$ $h(D-G)=1$ $h(F-G)=1$ $h(B-G)=10$ $h(E-G)=8$ $h(C-G)=20$ $h(G-G)=0$ Create a fringe and provide an order in which nodes are expanded by the A* algorithm until the goal G is reached and mention the total cost obtained.	4 Marks, CO1, CO2
Q1.2.	State and prove the condition under which the A* search algorithm is guaranteed to be optimal.	3 Marks, CO1, CO2
Q2.1.	Write the CSP formulation for a classroom-scheduling problem where five classes must be allocated to three rooms, with the constraint that any two classes occurring at the same time cannot share the same room. i. Clearly specify the variables, domains, and constraints. ii. Name the algorithm typically used to solve such CSPs and briefly explain how it works with a pseudo code.	2 Marks, CO1, CO3 2 Marks, CO1, CO3
Q2.2.	Describe three methods that can improve the efficiency of solving this CSP (such as variable-ordering, value-ordering, or consistency-checking techniques).	3 Marks, CO1,CO3
Q3.1.	An MDP is modeled by the tuple $\langle S, A, T, R, s_0, \gamma \rangle$. i. Explain every tuple briefly. ii. What is the policy in MDP? iii. Write the Bellman equation for the state-value function $V^\pi(s)$ in a Markov Decision Process (MDP). Explain the meaning of each term in the equation.	1 Mark, CO4 1 Mark, CO4 2 Marks, CO4

Q3.2.	Consider an autonomous drone delivery agent. It is at state S_0, must choose between:  Route A: a long flight that <i>guarantees</i> reaching the destination with cost 5. Route B: a shorter route with uncertain wind conditions. With probability 0.4 the drone reaches the destination with cost 2. With probability 0.6 it is pushed to a holding zone S_1, also costing 2. *if $V(S_1)=1$ and $V(S_g)=0$ (Random initialization) i. Using a discount factor $\gamma = 1$, write the one-step Bellman optimality backup equation for the drone's value at state S_0. ii. Which route should the drone choose? Explain.	2 Marks, CO4 1 Mark, CO4																				
Q4.1.	What is the twist in Reinforcement learning over MDP model? Explain model-based and model-free reinforcement learning with a real-world example.	3 Marks, CO4																				
Q4.2.	For the given data on executing a policy "π" <table border="1" style="border-collapse: collapse; text-align: center; margin-right: 10px;"> <tr> <th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr> <tr> <th>A</th><td>↓</td><td>↓</td><td>→</td><td>+100</td></tr> <tr> <th>B</th><td>→</td><td>→</td><td>↑</td><td>←</td></tr> <tr> <th>C</th><td>→</td><td>→</td><td>↑</td><td>-100</td></tr> </table> (A1, D, -1) (A1, D, -1) (B1, R, -1) (B1, R, -1) (B2, R, -1) (B2, R, -1) (B3, U, -1) (B3, U, -1) (A3, R, -1) (C3, U, -1) (A2, D, -1) (C4, -100) (B2, R, -1) (B3, U, -1) (A3, R, -1) (A4, 100) Estimate: $T(B1,R,B2)$, $T(A3,R,A4)$, $V^\pi(A1)$, $V^\pi(B3)$? Given, $T(\cdot)$ is a Transition model in MDP, $V^\pi(\cdot)$ is a reward function.		1	2	3	4	A	↓	↓	→	+100	B	→	→	↑	←	C	→	→	↑	-100	4 Marks, CO4
	1	2	3	4																		
A	↓	↓	→	+100																		
B	→	→	↑	←																		
C	→	→	↑	-100																		
Q5.1.	What is the advantage of First order logic over Proportional logic in knowledge representation languages.	2 Marks, CO1, CO5																				
Q5.2.	Use the below facts and using semantic network conclude "Tom is a Mammal". • Tom is an instance of dog • Tom caught a cat • Tom is owned by Roshan • Tom is brown in color • Dogs likes bones • The dog sat on the mat • The dog is a mamma • A cat is an instance of animal • All mammals are animals • Mammals have fur	5 Marks CO5																				

*****All The Best*****