



JK Lakshmipat University, Jaipur
Department of Computer Science and Engineering
Artificial Intelligence (CS-1224)
End-Term, Date: December 09, 2024

Time: 2.5 hours

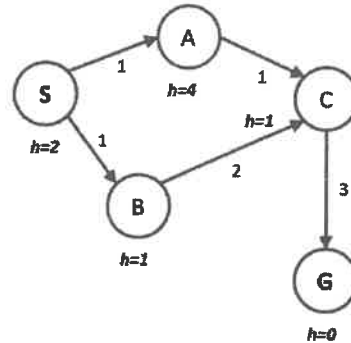
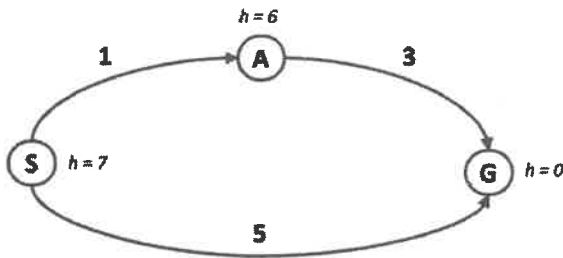
Semester V B.Tech. CSE

Max mark: 35

Please read the following instructions carefully.

- There are 8 questions printed on both sides.
 - **No marks** for providing just expressions/answers unless accompanied with correct justification and/or derivation.
 - In case of any doubt, make your assumption, write it clearly and continue. **Do not call your instructor.**
1. (3+3 points) If we run A* just as a sum of g and h costs on the images provided in the following figure, we realize that it is not sufficient to ensure optimality. More conditions are required to be met for A* to be optimal. Explicitly state the issues and the conditions that will make A* optimal for these cases. (CO1, CO2)

Fig for Q1



2. Consider n queens problem. Recall the formulation of it in which variables are given as $X_{ij} \in \{0, 1\}$. To be precise, i represents the row number and j represents the column.
- (a) (2 points) Write the set of constraints.
- (b) (3 points) Consider the start state given to you is $\{X_{31}, X_{22}, X_{33}, X_{24}\} = 1$, i.e., the value of the each of the provided variables 1. Apply hill climbing using min-conflicts heuristic to reach to the final state. Draw all the steps and reason for transition to next state at each step. (CO1, CO2, CO3)

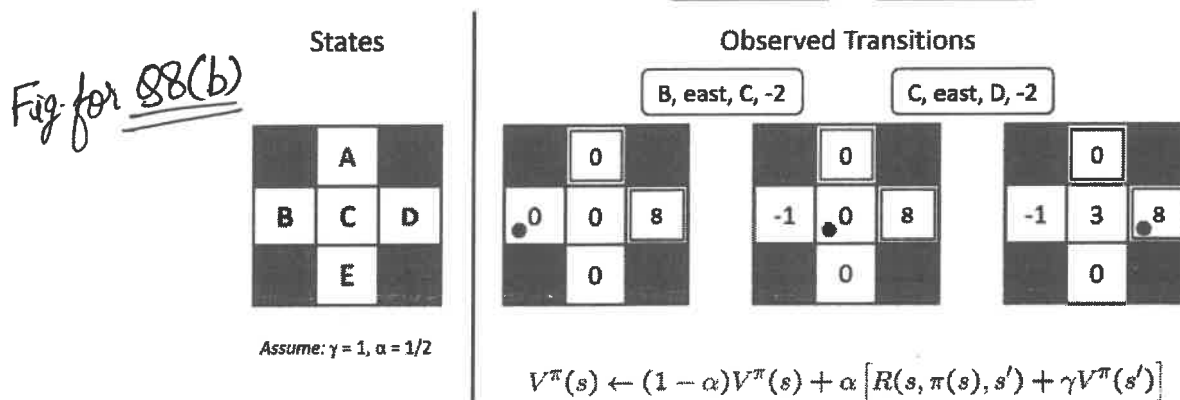
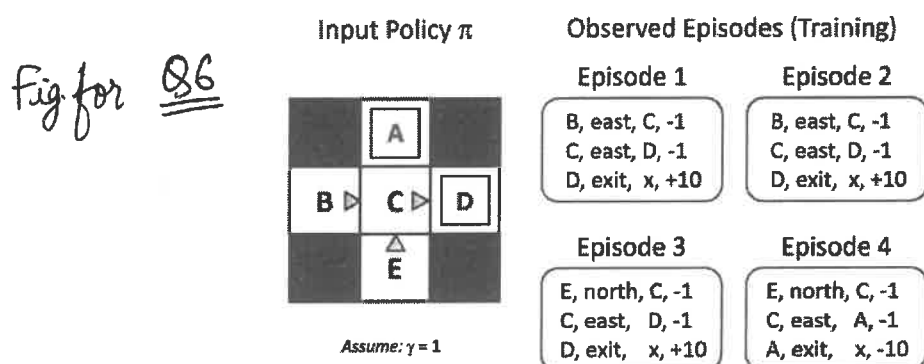
Fig for Q3

10				1
a	b	c	d	e

3. (a) (1+1 points) For $\gamma = 1$, what is the optimal policy if the agent starts in state c ? What if the agent starts in state d ?
- (b) (1+1 points) For $\gamma = 0.1$, what is the optimal policy if the agent starts in state c ? What if the agent starts in state d ?

(CO4, CO5)

4. Remember the red and blue machine game discussed during the classes. The probability of earning \$1 from blue machine in one round is 1. The probability of earning \$10 from red machine in one round is 0.2 and \$0 otherwise.
- (1 point) What is the expected amount of rewards earned if the agent plays only red machine for 100 rounds?
 - (2 points) What is the expected amount of rewards earned if the agent chooses to play on each machine with probability 0.5 for 200 rounds?
 - (1 point) What will be your strategy to maximize the rewards in 100 rounds if the probabilities provided in this question are not known but the rewards are known? Write your reasoning clearly. (CO1, CO4)
5. (2+2 points) Explain with proper example and diagram the difference between policy evaluation and policy extraction. (CO4, CO5)
6. (2+2 points) Make a model for the following input policy and training data that will enable you to solve Bellman equations in this case (but you don't have to solve them). (CO4, CO5)



7. (2 points) Assume that an agent has learnt optimal q-values for all the states. Hence, it can derive an optimal policy. Also assume that we are running ϵ greedy algorithm for exploration and exploitation. If the value of ϵ is chosen to be 0.8, will the agent achieve the maximum expected reward to reach goal state from the start state? Why? (CO1, CO4, CO5)
8. (a) (1+1+1 points) Write down the equations governing Q-learning. Also write down the equations governing values. Compare them.
- (b) (2+1 points) In the mentioned figure, show how are the values of all the states computed. Explain the significance of the equation in the figure.

(CO1, CO4, CO5)