Indian Institute of Engineering Science and Technology, Shibpur

B. Tech 8th Semester End-Semester Examination,

April 2024

Artificial Intelligence (CS4201)

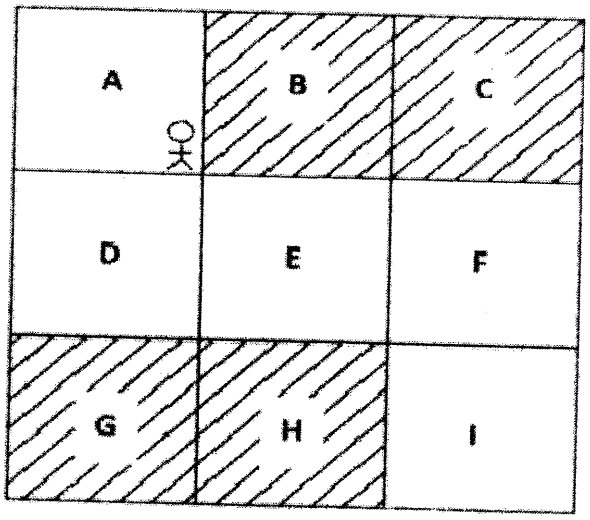
Full Marks: 50 **Time: 3 Hours**

Answer any three questions. Each question carry equal Marks

Two marks are allotted for precise answer

1. (i) Explain the role of discount factor in reinforcement learning, considering $\gamma = 0$, $\gamma = 1$ and γ varies from 0.2 to 0.8.

(ii) In a ***grid world*** **environment**, the goal of the *agent* is to reach state **I** starting from state **A** without visiting the *shaded states*. In each of the states, the agent can perform any of the four actions: *up, down, left, and right* to achieve the goal.



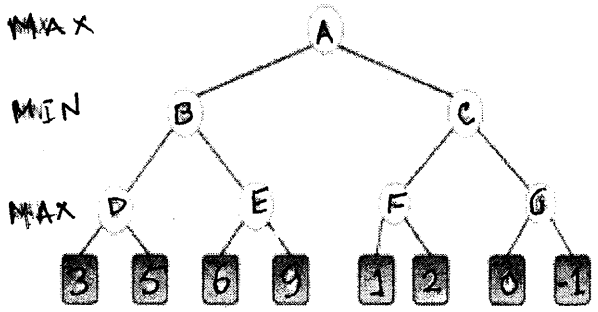
Explain what is the outcome of stochastic policy with help of the grid world environment, assuming given a state **A**, and suppose the stochastic policy returns the probability distribution over the action space as [0.10, 0.70, 0.10, 0.10].

(iii) How the Q-function differs from the value function of Reinforcement Learning?

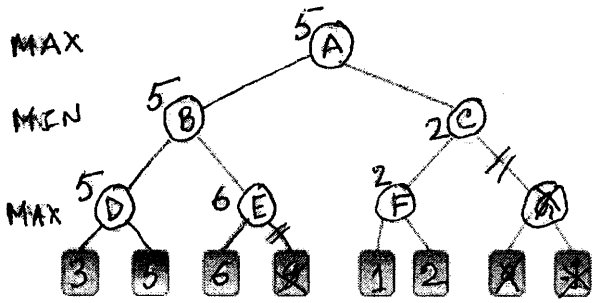
(iv) Write the Bellman equation of calculating updated Q-function considering state S and Action A.

4.5+5.5+3+3

2. (i) Initial and Final game trees are given below. Explain how the final game tree is achieved using appropriate algorithm.



Initial



Final

(ii) Write the properties of MINIMAX Game search algorithm.

(iii) When do you apply α-β pruning in MINIMAX Tree? 8+4+4

3. (i) Describe the key differences between a Mamdani FIS Model and a Takagi-Sugeno-Kang FIS Model.

(ii) Air pollution studies have shown that the air quality is very poor during peak traffic hours in Kolkata. Two expert Pulmonologists on the basis of their several years of experience, categorized the respiratory diseases into three groups: (i) Bronchitis (B), (ii) Asthma (A), (iii) COPD (C).

Basic probability assignment (m) of two experts is given below.

Disease	A	B	C	A∪B	A∪C	B∪C	A∪B∪C
Expert1 (m1)	0.10	0..20	0.40	0.06	0.07	0.08	0.09
Expert2 (m2)	0.20	0.30	0.25	0.06	0.06	0.07	0.06

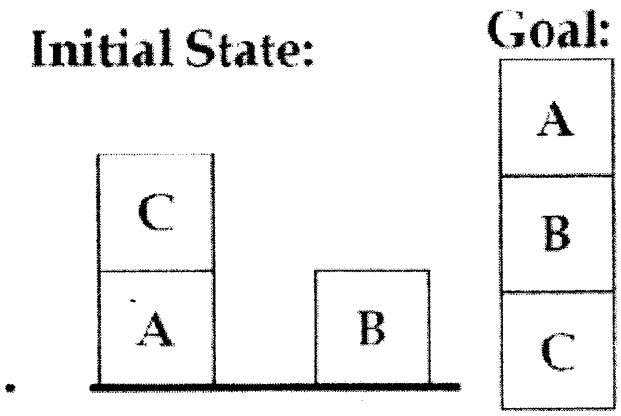
Determine the joint basic probability assignment (m12) using Dempster-Shafer's rule of combination.

(iii) What is the purpose of Belief Network?

(iv) What is the need of Probabilistic reasoning in AI?

3+7+ 3+3

4. (i) What do you mean by Sussman anomaly? Explain it using the following example.



Initial State: (on-table A) (on C A) (on-table B)
(clear B) (clear C) Goal: (on A B) (on B C)

(ii) What is Markov decision process?

(iii) Write Q-learning algorithm (3+5) + 3+5

5. (i) What are the differences between Games and Search Problems in AI?

(ii) Suppose Fuzzy relation R1 and R2 are defined on X×Y, Y×Z, respectively. X, Y and Z are universe of discourse such that $x \in X$, $y \in Y$, $z \in Z$. Find out the fuzzy relation R3 on X×Z.

(iii) If you know that coin is fair with 90% certainty then what is the value of BELIEF (Head) and BELIEFE (~Head)?

(iv) Explain Exploration VS. Exploitation dilemma. 3+5+4+4