Qn. Set Code-1

Semester: 6th
Programme: B.Tech
Branch: IT

SPRING END SEMESTER EXAMINATION-2023

6th Semester B.Tech

ARTIFICIAL INTELLIGENCE

CS 3011

(For 2021 (L.E), 2020 & Previous Admitted Batches)

Time: 3 Hours Full Marks: 50

Answer any SIX questions.
Question paper consists of four SECTIONS i.e. A, B, C and D.
Section A is compulsory.
Attempt minimum one question each from Sections B, C, D.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

SECTION-A

1. Answer the following questions. [1 × 10]

(a) Mention five state-of-the-art applications of AI.

(b) Which agent structure deals with happy and unhappy states? Justify.

A. Simple reflex agent
B. Model-based reflex agent
C. Goal-based agent
D. Utility-based agent

(c) **Start State:**

7	2	4
5		6
8	3	1

Goal State:

	1	2
3	4	5
6	7	8

In the above 8-puzzle problem, the actual number of steps to reach the given goal state is 26. If the heuristic

h1 is "Number of misplaced tiles" and the heuristic h2 is "Total Manhattan distance", then which of the following statement(s) is/are correct? Justify.

A. only h1 is admissible heuristic

B. only h2 is admissible heuristic

C. both h1 and h2 are admissible heuristics

D. None of h1 and h2 is admissible heuristics

(d) List four performance measures for a search algorithm. Indicate these measures for BFS and DLS.

(e) Describe the terms shoulder, plateau, global maxima and local maxima in any local search by drawing the state space landscape.

(f) Hill climbing has the following variant(s): Justify your answer

A. Stochastic Hill climbing

B. First choice Hill climbing

C. Random restart Hill climbing

D. All of the above

(g) Justify that pruning achieves better time complexity than mini-max algorithm.

(h) To which depth does the alpha-beta pruning can be applied? Justify.

(i) Mini-max algorithm uses the property of which Search/Algorithm? Justify.

(j) Wumpus World, a classic problem, is one of the best examples of:

A. Single player Game

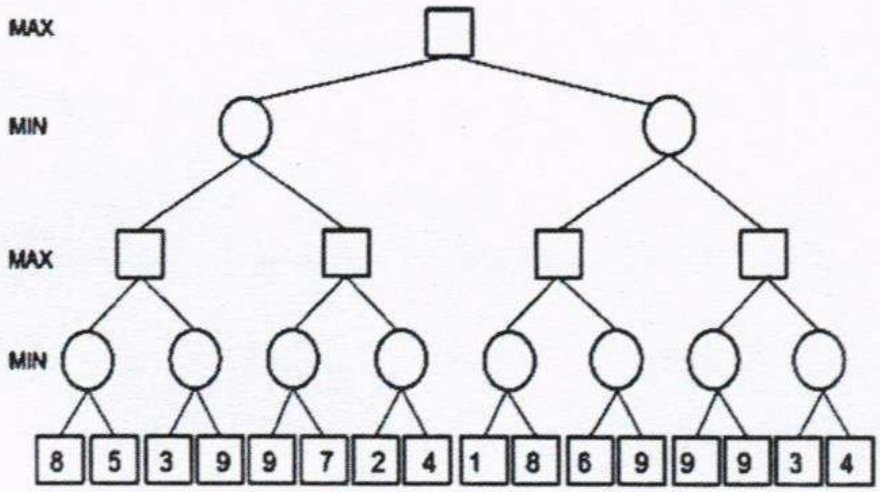
B. Two players' Game

C. Reasoning with Knowledge

D. Knowledge based Game

SECTION-B

2. (a) How does alpha-beta pruning work? Define the terms alpha and beta. Solve the following example and show how alpha-beta pruning helps in pruning the search tree. [4]



(b) Solve the following cryptarithmetic problem (by using CSP principles): [4]

CROSS + ROADS = DANGER.

Also find the value of **O + R + A + N + G+ E**

3. (a) Explain how to formally define an Australia map coloring problem as a constraint satisfaction problem (CSP)? Provide the constraint propagation and backtracking process in relation to this map coloring problem. [4]

(b) Briefly explain the following in connection with CSP through suitable examples: [4]

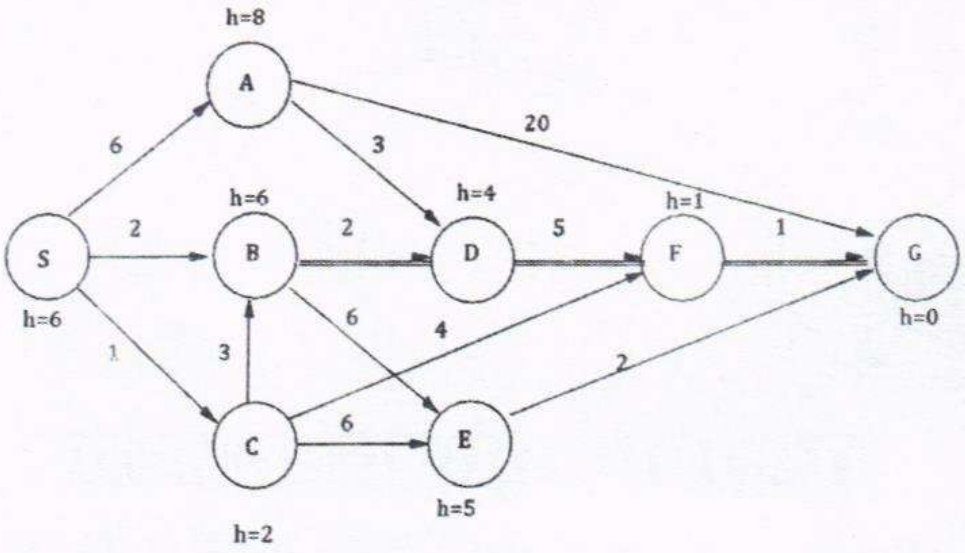
I) Types of variables

II) Types of constraints

III) Types of consistencies

SECTION-C

4. (a) Consider the search problem below with start state **S** and goal state **G**. The transition (or step) costs are indicated next to the edges and the heuristic values are indicated either above or below the states. [4]



(i) What is the path and path cost if best first search algorithm is used to reach the goal?

(ii) What is the path and path cost if A* search algorithm is used to reach the goal?

In each case, draw and use the search tree.

(b) Briefly state the five components of problem formulation for a problem-solving agent. Formulate each of the following toy problems by stating these five components: [4]

i) 8-puzzle (sliding tile) problem
ii) 8-queen problem

5. (a) Briefly explain the basic process of Genetic Algorithm (GA). Apply GA to 8-queen problem. (Carry out at least two iterations.) [4]

(b) Explain a learning agent with suitable diagram. Describe its various components with an example for each of these components. [4]

6. (a) I. What is task environment? How is it specified? Obtain the PEAS description for following agents: [4]

i) Medical diagnosis system

ii) Mars rover

iii) Part-picking robot

II. Differentiate between Cooperative multi-agent and Competitive multi-agent through suitable example.

(b) In the following 8-puzzle problem, initial and final states are given: [4]

Initial State

2	8	3
1	6	4
7		5

Goal State

1	2	3
8		4
7	6	5

Find the most cost-effective path to reach the final state from initial state using A* Algorithm.

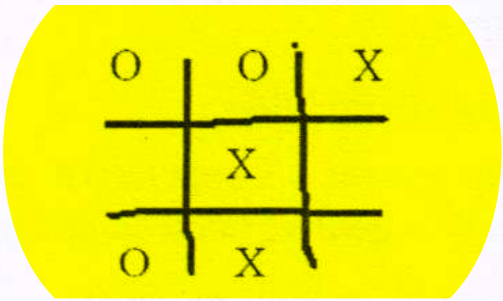
[Consider the path cost of node n i.e. g(n) = Depth of node n and heuristic value of node n i.e. h(n) = Number of misplaced tiles.]

SECTION-D

7. (a) Write the Steepest Ascent Hill climbing search algorithms. Analyse the performance of this algorithm based upon appropriate performance evaluators. Explain various issues for which hill climbing often gets stuck and possible measures to tackle these issues. [4]

(b) Define Minimax values used for MAX, MIN and Terminal states of a game tree. What do you understand by the term "Optimal strategy"? [4]

Suppose following is the initial state of a Tic-Tac-Toe game:



If 'X' symbol belongs to MAX player and 'O' symbol belongs to MIN player, then develop the game tree till all the terminal states are generated. Obtain the Minimax values of each node of this game tree if the utility values are assumed as **1** for a *Win*, **-1** for a *Loss* and **0** for a *Draw*. Now show the path from initial state to terminal state if both players play using optimal strategy.

8. (a) What is Logical Agent? What do you understand by soundness and completeness in inference mechanism? Give the PEAS representation and characteristics features for the example of "Wumpus World" problem. Considering this example, explain how the logical agent can solve the problem. [4]

(b) i) Differentiate between Propositional Logic (PL) and First Order Logic (FOL). [4]

ii) What is PDDL in classical planning? Give PDDL description for any one of the following examples:

(i) Air cargo transport
(ii) The spare tire problem
(iii) The blocks world

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