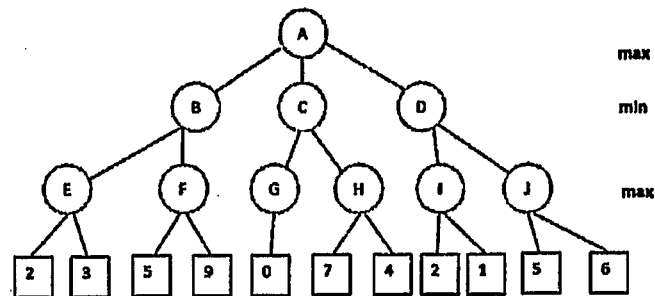


(b) Consider the following game tree where the indicated scores are from the MAX player's point of view.

- (i) Use minimax algorithm to find the optimal path traversed. Show all the steps involved.
- (ii) Which nodes will be pruned according to α - β pruning? (10)



(200)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5058

J

Unique Paper Code : 2344000022

Name of the Paper : Artificial Intelligence

Name of the Course : **Generic Elective**

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is Compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.
5. Write all the intermediate steps, wherever required to get full credits.

P.T.O.

SECTION A

1. (a) State the Modus Ponens rule and explain it in detail with the help of an example. (3)

- (b) Is the following given set unifiable? If yes, give the most general unifier.

$$Z = \{Q(a, g(x, a), f(y)), Q(a, g(f(b), a), x)\} \quad (3)$$

- (c) What will be the output of the following statement in Prolog, and Why?

$$?- P \text{ is } 7-3, P = 1+3. \quad (3)$$

- (d) Express the following sentences as conceptual dependency structures.

(i) Ben is a programmer.

(ii) Charlie drove the pickup fast. (4)

- (e) Outline the key differences between Interpretable AI and Explainable AI. (4)

- (f) Provide an example each of type 1 and 2 Chomsky's hierarchy of grammar. (4)

- (b) Differentiate between the following task environments of an AI agent with the help of concrete examples :

(i) Deterministic vs. Non-deterministic

(ii) Known vs. Unknown (8)

7. (a) Using the provided grammar, demonstrate how the sentence 'Sam slept on the chair' can be parsed through both top-down and bottom- up methods. (5)

$$S \rightarrow NP \ VP$$

$$NP \rightarrow N \mid DET \ N$$

$$VP \rightarrow V \mid V \ PP$$

$$PP \rightarrow PREP \ NP$$

$$N \rightarrow \text{Sam} \mid \text{chair}$$

$$V \rightarrow \text{slept}$$

$$DET \rightarrow \text{the}$$

$$PREP \rightarrow \text{on}$$

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6

5. (a) Highlight the limitations of the Hill Climbing algorithm. Suggest how these limitations can be addressed. (7)

- (b) Consider the following axioms : (8)

February

Vapours

(Cold $\wedge$ Precipitation) $\rightarrow$ Snowstorm

February $\rightarrow$ Cold

Vapours $\rightarrow$ Precipitation

Convert them into equivalent clausal forms and prove that Snowstorm is true using resolution tree. Demonstrate each step thoroughly.

6. (a) Solve the following 8-puzzle problem using A* search algorithm. Show the heuristic values at each step. (7)

2		3
1	8	4
7	6	5

START

1	2	3
8		4
7	6	5

GOAL

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3

- (g) Convert the following sentences into predicate logic : (4)

(i) Every AI student is a CS student.

(ii) Some cars blow horn at night.

- (h) Give a PEAS (Performance Environment Actuators Sensors) description of the task environment: Vacuum cleaner. (5)

SECTION B

2. (a) Solve the following cryptarithmic problem using constraint satisfaction. (5)

$$\begin{array}{rcccccc}
 & C & R & O & S & S \\
 + & R & O & A & D & S \\
 \hline
 D & A & N & G & E & R
 \end{array}$$

- (b) Write a program in Prolog to find the factorial of a number. (5)
- (c) Transform the following formula to prenex normal form. (5)

$$\forall xy (\exists z P(x, z) \ \& \ P(y, z)) \rightarrow \exists u Q(x, y, u)$$

P.T.O.

3. (a) What are learning agents? Discuss the components of a learning agent with the help of a diagram.

(5)

- (b) Develop a parse tree for the sentence "**The clever boy helped the dog in the park**" using the following rules. (5)

$$S \rightarrow NP VP$$

$$NP \rightarrow N$$

$$NP \rightarrow DET N$$

$$VP \rightarrow V NP$$

$$VP \rightarrow V PP$$

$$VP \rightarrow V NP PP$$

$$PP \rightarrow PREP NP$$

$$DET \rightarrow ART ADJ$$

$$DET \rightarrow ART$$

$$N \rightarrow \text{boy} \mid \text{dog} \mid \text{park}$$

$$V \rightarrow \text{helped}$$

$$ART \rightarrow \text{the} \mid \text{a}$$

$$ADJ \rightarrow \text{clever}$$

$$PREP \rightarrow \text{in}$$

- (c) Draw the state space graph for the two-cell vacuum world problem. (5)

4. (a) Determine whether each of the following sentences is satisfiable, contradictory, or valid. (4)

$$S1: (P \vee Q) \ \& \ (P \vee \sim Q) \vee P$$

$$S2: P \vee Q \ \& \ \sim P \vee \sim Q \ \& \ P$$

- (b) Illustrate the benefits and risks of Artificially Intelligent Systems. (5)

- (c) Compare and contrast BFS and DFS algorithms in detail. Apply DFS on the given tree using appropriate data structure. (Use node 'A' as the source node). (6)

