6E7105

Total No. of Questions : 22 Total No. of Pages : 04

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6E7105

B.Tech. VI-Sem. (Main/Back) Exam. May–2025

Artificial Intelligence and Data Science

6AID4-05 / Principles of Artificial Intelligence

CS, IT, AID, CAI

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates :

Attempt all ten questions from Part-A, five questions out of seven questions from Part-B and three questions out of five questions from Part-C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in Form No. 205)

1. ..... 2. .....

PART-A **[10×2=20]**

(Answer should be given up to 25 words only)

All questions are compulsory

Q.1. Define Rational Agent and Intelligent Agent.

Q.2. What is the role of Heuristic function in informed search?

Q.3. List the three main components of a Constraint satisfaction problem.

Q.4. What is rule based knowledge base?

Q.5. Construct a truth table for the compound proposition $(p \rightarrow q) \rightarrow (q \rightarrow p)$.

Q.6. What are support vectors in SVM?

Q.7. What are Neural Networks?

Q.8. Define Universal and Existential quantifiers in FOL with examples.

Q.9. What is initial and goal state in water jug problem?

Q.10. Define uncertainty and list the causes of uncertainty.

PART-B [5x4=20]

(Analytical/Problem-solving Questions)

Attempt any five questions

Q.1. Explain the differences between Breadth First Search and Depth First Search algorithms with the help of an example.

Q.2. Compare forward chaining and backward chaining used in expert systems.

Q.3. State Bayes' theorem and explain its significance in probability estimation.

Q.4. What is Robotics? Mention two real-world applications of robots.

Q.5. What is Market Basket analysis and how it is used in recommendation systems?

Q.6. Explain the difference between constants, variables, predicates, and functions in FOL. Convert the following sentence into FOL : "all humans are mortal".

Q.7. Solve the following 3×3 sliding puzzle given with the initial and goal state.

Initial State Goal State

1	2	3	⇒	1	2	3
8		4		4	5	6
7	6	5		7	8	

PART-C [3x10=30]

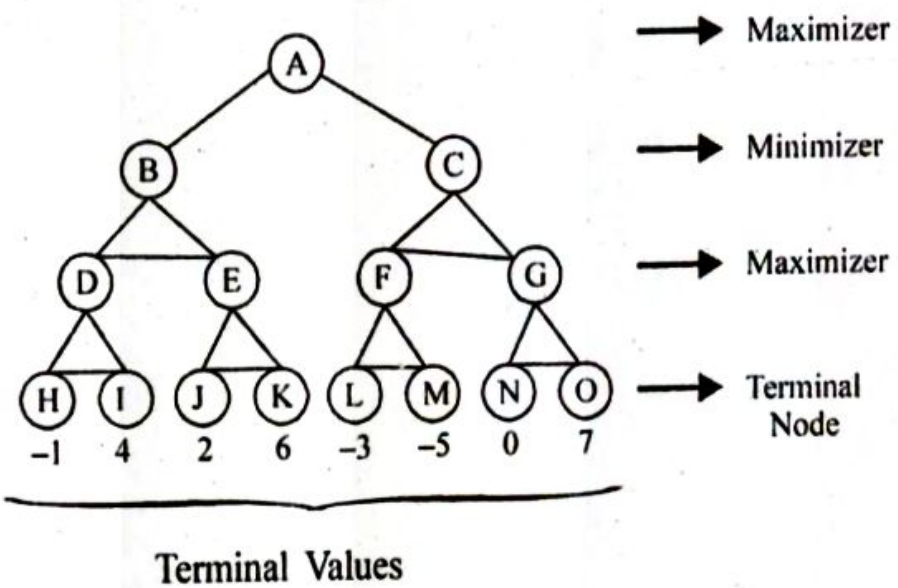
(Descriptive/Analytical/Problem-Solving/Design Questions)

Attempt any three questions

Q.1. Write the algorithm for the A* search technique. Using a suitable example, explain how A* search is more effective than the Greedy Best-First Search technique.

Q.2. Explain the concepts of Supervised Learning and Unsupervised Learning in Machine Learning. Discuss their key differences with suitable examples. Additionally, compare the advantages and limitations of both approaches.

Q.3. Given the following game tree, apply the Minimax algorithm to determine the optimal move for the maximizing player. Then, apply Alpha-Beta Pruning to the same tree and show which nodes are pruned. Compare the number of nodes evaluated in both cases. Compare time efficiency in terms of the number of nodes processed.



Q.4. Explain the steps involved in Natural Language Processing (NLP). Provide examples of how techniques like tokenization, part-of-speech tagging, named entity recognition (NER), and sentiment analysis are used in NLP. Discuss any one example highlighting the importance on NLP in real-world applications.

Q.5. Consider the following knowledge base in First-Order Logic (FOL) :

$\forall x \left(\text{Cat}(x) \rightarrow \text{Animal}(x)\right)$

$\forall x \left(\text{Animal}(x) \rightarrow \text{Living}(x)\right)$

$\forall x \left(\text{Living}(x) \wedge \text{Friendly}\,(x) \rightarrow \text{Pet}(x)\right)$

Cat(Tom)

Friendly(Tom)

Task : Using Theorem Proving in First-Order Logic. Prove that Pet(Tom).

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