

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1726

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Unique Paper Code : 2342013601

Name of the Paper : Artificial Intelligence

Name of the Course : B.Sc. (H) Computer Science

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

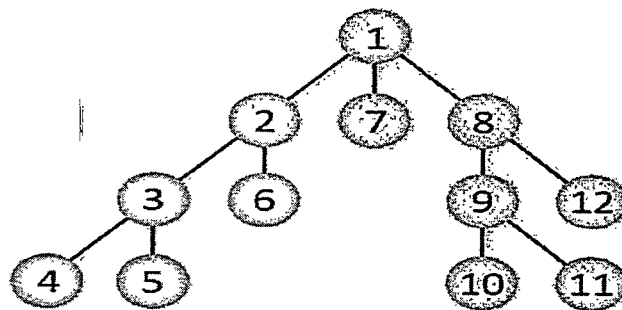
**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections A and B. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. All parts of a question must be answered together.

**Section A**

(Compulsory)

- 1 (a) Explain the architecture of a learning agent with its components. (5)
- (b) Mention any two differences between Breadth First Search (BFS) and Depth First Search (DFS). Illustrate the result of BFS and DFS on the following tree. (5)



- (c) Consider the following predicates: (5)  
 $P(f(x),g(x))$  and  $P(y,y)$ 
  - i. Determine whether the above expressions can be unified.
  - ii. If unification is possible, find the most general unifier (MGU). If not, clearly explain the reason.
- (d) What is the Chomsky Hierarchy of Grammars? Write the properties of Type 0, Type 1, Type 2, and Type 3 grammars with examples. (5)
- (e) How do the cut (!) operator and fail predicate affect backtracking? Write a Prolog program to implement fact (N, F) that computes the factorial of a number N, storing the result in F. (5)

P.T.O.

- (f) What are Conceptual Dependency (CD) primitives? Explain any two of the following: (5)  
ATRANS, PTRANS, MTRANS, PROPEL, INGEST. Represent the following sentences using appropriate CD primitives:

- i. The boy threw the ball.
- ii. She ate an apple.

### Section B

- 2 (a) Convert the following into clausal form: (7)  
A1: If x is a student, then x studies.  
A2: Rahul is a student.  
A3: If someone studies, they pass.

Express the following sentences as conceptual dependency structures:

- i. Charlie drove the pickup fast.
- ii. Ram is a programmer.

- (b) A company is developing an intelligent self-driving car system. The system uses sensors to detect the environment, processes the information, and takes actions such as braking, accelerating, and steering. (8)

- i. Identify the components of an intelligent agent in this system by specifying:

- Sensors
- Actuators
- Environment
- Performance

- ii. Draw a diagram of the agent structure showing the interaction between the agent and its environment.
- iii. Is the self-driving car an example of Weak AI, Strong AI, or Narrow AI? Justify your answer.

- 3 (a) Prepare a script for "Online shopping" using appropriate script elements (roles, props, places, scenes, entry conditions and post conditions etc.). (7)

- (b) Explain Turing Test approach to AI. How is Turing Test approach different from the rational Agent approach? (8)

- 4 (a) Differentiate between the following: (8)

- i. Fully observable vs. partially observable environment
- ii. Deterministic vs. stochastic environment
- iii. Model-based agent and Goal-based agent
- iv. Goal-based agent and Utility-based agent

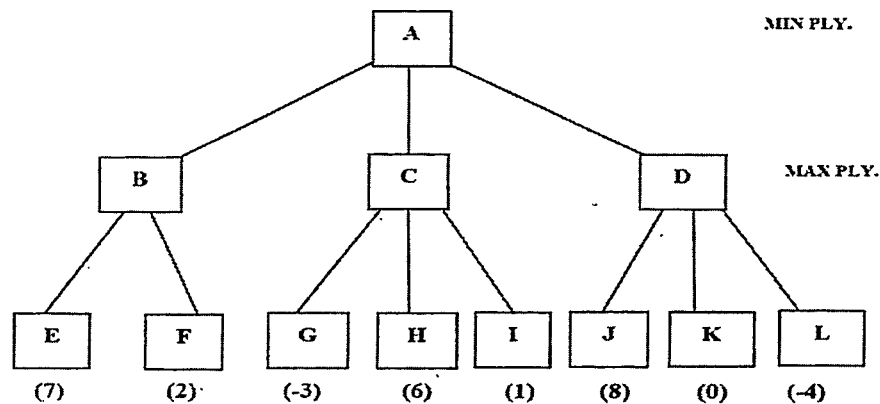
(b) Write a Prolog program to perform the following list operations:

(7)

1. Check whether an element is a member of a list.
2. Find the length of a list using recursion.
3. Concatenate two lists.
4. Find the sum of elements in a list.

5 (a) Define Heuristic Search technique. Why should a heuristic function of A\* underestimate? (7)

(b) Consider the following game tree with ply depth 2 where the indicated scores are from the MIN player's point of view. Which move A should choose and why? Which nodes will be pruned according to the  $\alpha$ - $\beta$  pruning procedure? Give justifications of each. (8)



6 (a) Using the *Constraint Satisfaction approach*, solve the following crypt-arithmetic problem: (7)

$$\begin{array}{r}
 SEND \\
 + MORE \\
 \hline
 MONEY
 \end{array}$$

Show all the steps.

(b) What are the differences between Recursive Transition Network (RTN) and Augmented Transition Network (ATN)? (8)

Given a grammar  $G = (V_T, V_N, S, P)$

where:

$V_T$  = Set of terminal symbols,

$V_N$  = Set of non-terminal symbols,

$S$  = Start symbol

$P$  = Production rules

$S \rightarrow NP VP$   
 $NP \rightarrow DET N$   
 $VP \rightarrow V PP$   
 $PP \rightarrow PREP NP$   
 $N \rightarrow \text{bird} \mid \text{tree}$   
 $V \rightarrow \text{flew}$   
 $DET \rightarrow \text{The} \mid \text{a}$   
 $PREP \rightarrow \text{over}$

Construct the parse tree for "The bird flew over the tree."

7

Consider the following axioms:

(15)

- i. **A1:** Sneha likes all easy subjects.
- ii. **A2:** Mathematics and Physics are easy subjects.
- iii. **A3:** Anything that anyone studies and passes without extra help is an easy subject.
- iv. **A4:** Rohan studies Chemistry and passes without extra help.
- v. **A5:** Anyone who takes extra help does not pass without extra help.
- vi. **A6:** Meera studies every subject Rohan studies.

Express the above axioms into First Order Predicate Logic (FOPL) statements and convert them into clausal form. Using resolution principle, prove the statement "Sneha likes Chemistry."