(c) Define agent and differentiate between goal-based and utility-based agent. (5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5507 **J**

Unique Paper Code : 2342013601

Name of the Paper : Artificial Intelligence

Name of the Course : **B.Sc. (H) Computer Science 2022 and Onwards (NEP-UGCF)**

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 **(Question 1).**
3. Attempt **any 4** questions from **Section B (Questions 2 to 6).**
4. Parts of the question must be answered together.

Section A

1. (a) Give two limitations of propositional logic (2)

   (b) What is weakly supervised learning? (2)

   (c) What are the limitations of hill climbing search algorithm? (3)

   (d) Define A* search algorithm and write its evaluation function. (3)

   (e) Transform the following sentence into disjunctive normal form: ~ (P V ~Q) & (R → S) (3)

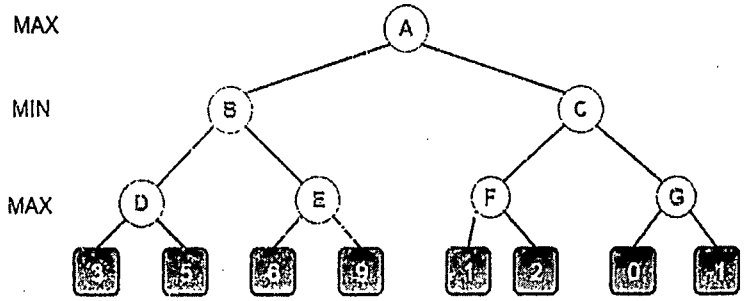
   (f) Write a PROLOG program to generate the n^{th} term of the Fibonacci series. (3)

   (g) Differentiate between deterministic and non-deterministic parser. (3)

   (h) Define Modus ponens rule. Explain using an example. (3)

   (i) Differentiate between breadth first search and depth first search algorithms. (4)

What move should MAX(A) choose and why? (5)



(b) Express the following sentences as conceptual dependency structure: (5)

- Joe is a professor.
- Rohan gave Tina a box of chocolates.
- John pushed the wall.

P.T.O.

(c) Define any three properties of a sentence. Determine whether the following sentence is satisfiable, contradictory or valid: S: $P \rightarrow Q \rightarrow \sim P$ (5)

5. (a) Write a script for watching a movie in a cinema hall. (5)

(b) Transform the following into clausal form:

$\forall x[Brick(x) \rightarrow (\exists y[On(x, y) \& \sim Pyramid(y)] \& \sim \exists y[On(x, y) \& On(y, x)] \& \forall y[\sim Brick(y) \rightarrow \sim Equal(x, y)])]$

(5)

(c) Define a heuristic function? Why should the heuristic function of A* algorithm should never overerestimate the actual cost? (5)

6. (a) What is MiniMax algorithm? Consider the following game tree with ply depth 3, in which the indicated scores are from the MAX player's point of view.

(j) Write the PEAS for vacuum cleaner agent. (4)

Section B

2. (a) What is a rational agent? Differentiate the a partially observable and fully observable environment. (5)

(b) Express the following concepts as an associative network structure with interconnected nodes and labeled arcs:

"TechSolutions Inc. is a hardware manufacturing company. The company has three main departments: Production, Marketing, and Finance. Alice is the head of the Production department. Bob and Carol are production engineers. Carol is married to Dave, who works as a journalist for The Daily Times. They have two children and reside on Maple Avenue. Carol has brown hair and is five feet six inches tall." (5)

(c) What is chomsky hierarchy of grammars? Give the properties of type 1 and type 2 grammars. (5)

3. (a) Solve the following crypto arithmetic problem using constraint satisfaction. (6)

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  TWO
+ TWO
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 FOUR
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(b) Consider the following Knowledge Base: (9)

A1. If x is on top of y, y supports x.

A2. If x is above y and they are touching each other, x is on top of y.

A3. A cup is above a book.

A4. A cup is touching a book.

1. Translate statements A1 through A4 into clausal form.
2. Show that the predicate supports(book, cup) is true.

4. (a) Derive a parse tree for the sentence "Mary slept on the chair". Using the following grammar: (5)

S	→	NP VP
NP	→	N
NP	→	DET N
VP	→	V PP
PP	→	PREP NP
N	→	Mary | Chair
V	→	Slept
DET	→	the
PREP	→	on

(b) What is a Recursive Transition Network(RTN)? Give an example. (5)