

(Time: 2½ hours)

Total Marks: 75

- N. B.: (1) **All** questions are **compulsory**.
 (2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
 (3) Answers to the **same question** must be **written together**.
 (4) Numbers to the **right** indicate **marks**.
 (5) Draw **neat labeled diagrams** wherever **necessary**.
 (6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt any three of the following:

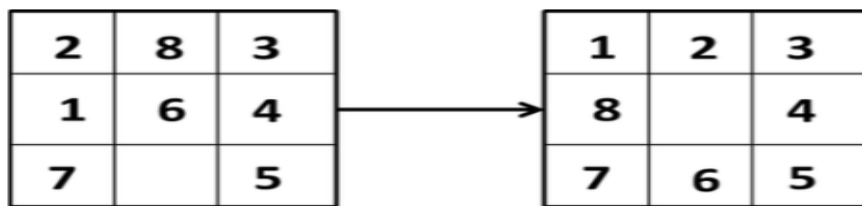
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- Explain any six types of foundational languages used in Artificial Intelligence in brief.
- Describe Turing test designed for satisfactory operational definition of Artificial Intelligence.
- Describe any five state-of-the-art of AI today.
- Explain PEAS description of the task environment for an automated taxi and medical diagnosis systems.
- Define agent. Explain any three types of agents. State and explain different agent terminologies.
- With a neat-labelled diagram explain Utility based agent.

2. Attempt any three of the following:

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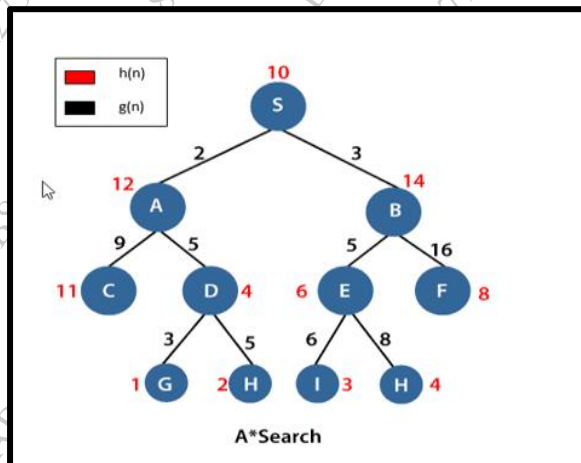
- Summarize the fundamental rules and constraints used in 8-Queens problem formulation and list its components.
- Formulate 8-puzzle problem for the following scenario and also mention the steps and path cost required to reach goal state.



Initial State

Goal State

- Explain A* algorithm with its different properties and also evaluate the below given search tree using A* algorithm and find out shortest path to reach goal node. (S is the root node and G is the goal node)



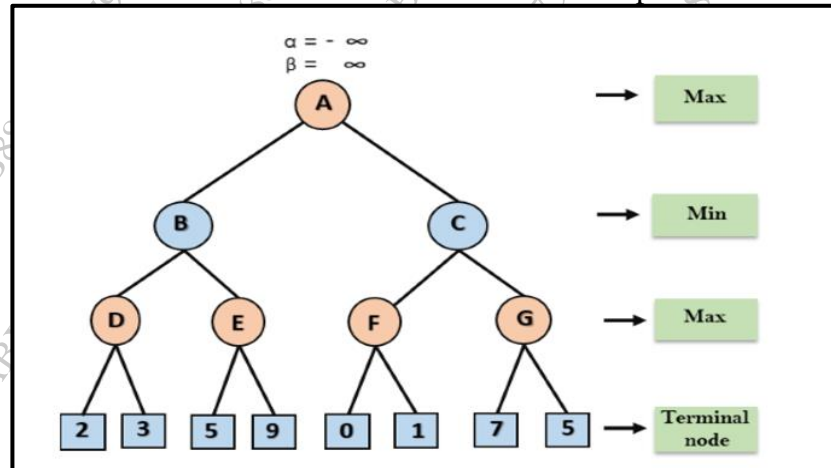
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- d. Identify and summarize the limitations and solutions of hill climbing search algorithm.
- e. Explain the working mechanism of genetic algorithm.
- f. Describe online search agents and unknown environments with its different types.

3. Attempt any three of the following:

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- a. Explain the various techniques required to get the best optimal solution. Also mention various elements of Game Playing search.
- b. Define Alpha Beta Pruning. Evaluate the below game tree by using alpha-beta pruning and find the value of node A and cutoff Values for alpha and beta node.



- c. List and explain the five key technological advancements that have significantly contributed to the current state of the art in game programs.
- d. Design a comprehensive system for a Knowledge-Based Agent (KBA), considering the need for a Knowledge Base and an Inference System. Explain the different operations the KBA performs within its Knowledge Base, and elucidate the various levels of sophistication a Knowledge-Based Agent can attain in problem-solving.
- e. Explain PEAS descriptors for WUMPUS world.
- f. Describe the roles and significance of each of the five connectives in Propositional Logic.

4. Attempt any three of the following:

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- a. Define First Order Logic. Explain syntax and semantics of first Order Logic.
- b. Convert the following sentences into predicate form:
 - i) Virat is software engineer.
 - ii) All vehicles have wheels
 - iii) Some-one speaks some language in this class.
 - iv) Everybody loves somebody sometime.
 - v) All software engineer develops software.
- c. Describe in detail knowledge engineering process using in First Order Logic.
- d. Differentiate between Propositional logic and First Order Logic.
- e. Convert the below given Facts into FOL and prove that "Colonel is a Criminal" using **Backward-Chaining**.
 - i) It is crime for an American to sell weapons to the enemy of America.
 - ii) Country Nono is an enemy of America.
 - iii) Nono has some Missiles.
 - iv) All the Missiles were sold to Nono by Colonel.
 - v) Missile is a weapon.
 - vi) Colonel is American.

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- f. What is Resolution? Mention the steps for resolution and also for converting FOL into conjunctive normal form (CNF). Consider following statements and perform the following conversion on it:-
- Convert to FOL.
 - Convert FOL to CNF.
 - Prove that **"Raja is angry"** using Resolution.
 - Draw Resolution tree.

Statements:-

- Rimi is hungry.
- If Rimi is hungry she barks.
- If Rimi is barking then Raja is angry.

5. Attempt any three of the following:

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- Explain progression and regression state-space search algorithm.
- Explain block world problem with suitable example.
- Create a description of multi-agent planning, including its various types of strategies.
- Write short notes on :-
 - Categories and Objects
 - Mental Events and Mental Objects
- Construct a semantic network representation with a suitable example to explain its concept.
- Write a short note on "The Internet Shopping World" while discussing its potential advantages and disadvantages.