**(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:** **15**
a. Explain any six types of foundational languages used in Artificial Intelligence in brief.
b. Describe Turing test designed for satisfactory operational definition of Artificial Intelligence.
c. Describe any five state-of-the-art of AI today.
d. Explain PEAS description of the task environment for an automated taxi and medical diagnosis systems.
e. Define agent. Explain any three types of agents. State and explain different agent terminologies.
f. With a neat-labelled diagram explain Utility based agent.

**2.** **Attempt _any three_ of the following:** **15**
a. Summarize the fundamental rules and constraints used in 8-Queens problem formulation and list its components.
b. 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**

c. 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**)



A\*Search

**[_Contd…_**

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:** **15**
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.
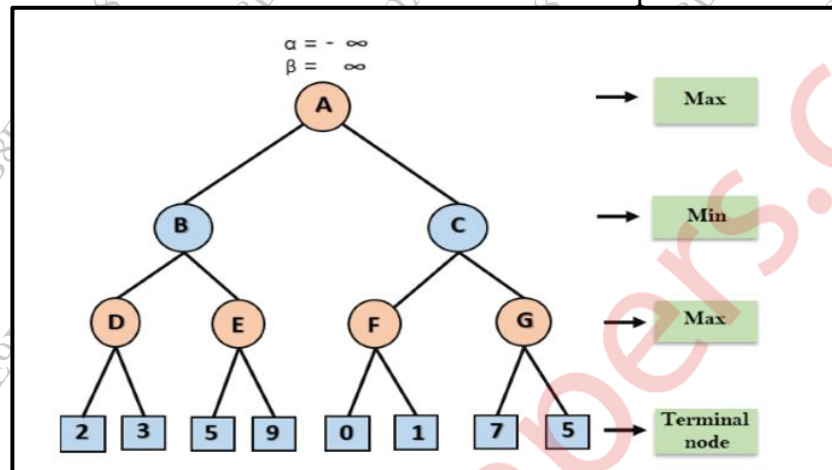


c. List and explain the five key technological advancements that have significantly contributed to the current state of the art in game programs.
d. Design a comprehensive system for a Knowledge-Based Agent (KBA), considering the need for a Knowledge Base and an Inference System. Explain the different 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:** **15**
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.

**[_Contd…_**

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:-
    i)      Convert to FOL.
    ii)     Convert FOL to CNF.
    iii)    Prove that **"Raja is angry"** using Resolution.
    iv)     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:**                                    **15**
a.  Explain progression and regression state-space search algorithm.
b.  Explain block world problem with suitable example.
c.  Create a description of multi-agent planning, including its various types of strategies.
d.  Write short notes on :-
    i)      Categories and Objects
    ii)     Mental Events and Mental Objects

e.  Construct a semantic network representation with a suitable example to explain its concept.
f.  Write a short note on "The Internet Shopping World" while discussing its potential advantages and disadvantages.

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