# **ANSWER KEY IAT-1**

1. (a) Describe in detail the four approaches to AI. (6) Ans.

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3) Compare and constract the dyinitions of Artificial Intelligence from the following points of Views Thinking Humanly Acting humanly. Thinking Rationally and Acting Rationally

> Thinking Humarly

dy: AI that the to think like a human think and solve problems.

Approach: studie and mimice how human think and solve problems.

Cog: AI Systems that they to understand human thought procure like how we learn or reason
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Pros and cons : can help us to understand human thinking useful for Citating human-like in tractions Hard to copy the complex human brain, can be thow to develop Acting thomonly algorition: As that thies to behave like a human Approach Acts in ways that an similar to human actions and behaviours e.g. Chatbots that talks like humans Robots that can interact socially with people Pros and cons: can scarnessly unteract with humans, good for customer Service and Entertainment many only mimic behaviour without true undires landing can be limited to simple talks Thinking Rationally definition: All that tries to think logically approach uses logic and rule to make decision and solve problems e.g : Expect systems that we toks to give advice or solve problems As that plans take based on logical steps. Pros and cons: Ejective in well - dyined once ; Erwore rogical and consistent ocutions con struggle with uncuar problems, might be too rigid Acting Kationally dyinin : AI that the to act in the but way to action goals : approach - optimized action to go the but Touth based on goal and information e.g -> say driving cors that navigar spicially and saying As is finance that make the but Environment decisions Pros and cons: - practical and goal focused, adapt well to change need clear goals, might not always match human value Ethics

(b) What are the capabilities a computer must possess to meet the Turing test? (4) Ans.

Capabilities a Computer must possess to meet the Toring lest

- 1. Natural language processing (NLP):

  "The computer must be able to understand and general human language fluently. This involves not Only understanding the Syntax and Semantice of language but also grasping the context and number.
- The computer must have a robust way of representing knowledge about the world. This include factual information, knowledge about the world the ability to use this knowledge to inform its response.
- \*The computer much to dimonitrate togical reasoning abilities this include understanding cause- and effect relationships, making instruction, and solving problems bound on the information provided.
  - the ability to learn from interactions and adapt reported accordingly is crucial. This might involve learning new facts, adjusting to the Evaluator's Style of
  - 5>. Understanding and Generating Contextual Responses:
    - The machine must understand the context of the Conversation and respond appropriately. This involves maintaining coherent over a series of Exchange and recognizing when to change topic or provide Elaborations.
  - 6) Handling Ambiguity and Incomplete Information;

quationing, and improving over time.

- "The computer should be able to handle ambiguous or incomplete information and still provide sensible response, much like a human would.
- Although not a strict requirement, the ability to recognize and respond to Emotional cous can ephane the believability of the machine's responses, making it seem more human-like.

  Passing the turing Test does not necessary imply that a machine passing the turing Test does not necessary imply that a machine posserue true understanding or Consciousnum. It murely suggest posserue true understanding or suggestatively sophisticated to be that the machine's response on suggestable sophisticated to be indistinguishable from those of a human in the country of the

2. (a) Define the following terms with respect to an intelligent agent: (i) Agent, (1) (ii) Environment, (1) (iii) percepts, percept sequence, (1) (vi) Agent functions, agent programs. (1)

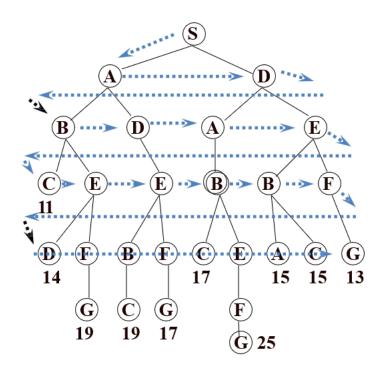
Ans.

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Define the following terms with respect to an intelligent agent:
1) Agent : An "agent" is anything that can be viewed as perceiving
         its Environment through sensors and acting upon that
          Environment through actuators
 ii) Environment : The environment is everything External to the egent
                 that the agent can interact with the provide the context
                 Within which the agent operates. The Environment can be
                 physical or virtual
iii) Sensors: Sensors are the mechanisms through which on agent perceives
           its environment. They gather data from the environment and
            Send it to the agent for processing. For example, a robot
            might use comeros and infrored sensors, while a software
            agent might use APIS to retrieve dato from a website
it) Actuators: Actuators are the components through which an agent acts upon
            actions or change in the environment. For a robot, actuators
           might include motors and serves that move its limbs, while a
            Software agent might modify databases or send menager
 1) percepts and percept sequence: . percepts: A percept is the agent's perception
                  at a given instant it is the input received from the
                  Convironment via the sensors
   Percept sequence of percept sequence is the history of all percepts an
         agent has received over time. This sequence can be used by the
         agent to man informed decisions band on past experience.
 Vi) Agent Functions and Agent Programs : • Agent Function: The agent function is
   a mathematical description that mops any given pricipt sequence to an
   action it is an abstract concept that define the behavior of the agent
   in response to any possible sequence of percepts
 Agent program: The agent program is the concrete imprementation of the
  agent function. It is a set of instruction or code that specific how the
  agent procure percepts and decide on actions. The agent program vers on
  the agent's hardware (or Software peatform) and determine it behavior in
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(b) Define and compare DFS (2), BFS (2), and IDS (2). Ans.

### **Breadth-first search-**

- The root node is expanded first (FIFO)
- All the nodes generated by the root node are then expanded
- And then their successors and so on
- Expand shallowest unexpanded node
- Frontier (or fringe): nodes in queue to be explored
- Frontier is a first-in-first-out (FIFO) queue, i.e., new successors go at end of the queue.
- *Goal-Test* when inserted.

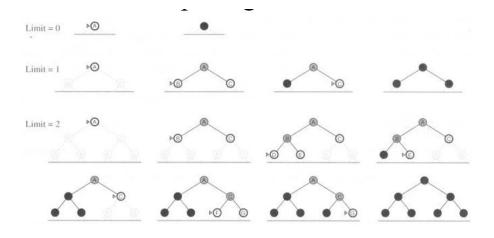


### Depth-first search-

- Always expands one of the nodes at the *deepest* level of the tree
- Only when the search hits a dead end
  - Goes back and expands nodes at shallower levels
  - Dead end à leaf nodes but not the goal
  - Expand deepest unexpanded node
  - Implementation:
  - frontier = LIFO queue, i.e., put successors at front

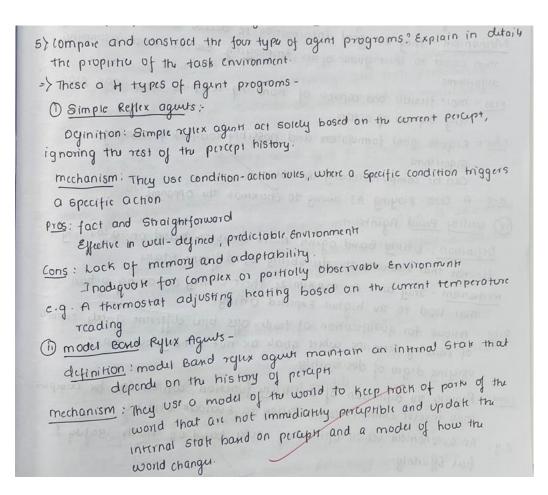
# Iterative deepening search-

- No choosing of the best depth limit
- It tries all possible depth limits:
- First 0, then 1, 2, and so on
- Combines the benefits of depth-first and breadth- first search
- optimal
- complete
- Time and space complexities
- reasonable
- suitable for the problem
- having a large search space
- and the depth of the solution is not known



3. (a) Write a brief note on any three types of agent programs. (2 marks for each type)

Ans.



Pros: Con handle partially Observable Environment Better performance in dynamic Environment Cons: more complex than simple reglex agent Regular o model of the Environments, which may not always eg. A robot vocum that keep track of cleaned and uncleaned areas 1 Goal- Band Agent Oginition - Goal Based agent act to achieve Specified goals, making decision based on the decirability of the outcome Methanism - They use good information to decide action that bring them closer to their goals of the Employing Search and planning eros: more flexible and capable of handling complex tours can plan long Sequence of actions Con: Require gow formulation and possibly complex pronning algorithms Can be computationally intensive e-g - A Chess- playing AJ aming to Checkmot the Opponent (1V) Utility Band Agent Definition: - Utility band agent make decision band on a utility function that Evaluate the durability of different States mechanism . They aim to maximize their Utility choosing action that lead to the highest expected utility. Pros: Allows for qualification of tradi-offs blu different goods copoble of randling scenarios where good are not binary but have varying degro of desirability cons : Require the definition of a utility function, which can be complet may involve extensive computation to Evaluat utility e.g. An autonomous vehicle optimizing route based on trath, saying & ful Efficiency

(b) Define a rational agent (1). Explain in detail the properties of the task environment (3).

Ans.

4) Define a Rational Agent

A Rational agent is an Entity that perceive its Environment through

Sensors and act upon that Environment through actuators to achieve

its good. A rational agent aims to maximize it performance

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Properties of Tosk Environment
1. Observability:
  tully observable -> The agent's sensors provide complete information about
  portially observable > The agent's sensors provide incomplet information
 Deterministic > The next State Of the Environment is completely differented
a) Ackminism
   by the current stair and the action executed by the agent
 Stochastic > The next State is portially random and cannot be
   predicted with certainity
     The agent's Experience is divided into atomic Episodu where
  3 · & pisodicity :
 Each Episodi consist of the agent preceiving and then performing
 a single action. subsequent spisodu do not depend on the action
  taken in previous once
 Sequential > The current decision could affect an future decision and
 the agent's action have long-term conquire
   Static The Environment closs not change while the agent is delibrating
4 · Static Vs Dynamic
 Dynamic: The Environment can change while the agent is delibro
       - ting , requiring the agent to adapt quickly
    Discrete the Environment consists of a finite number of distinct
5- Discrett V5 Continuous
  Continous : The Environment has a continuum of stance and actions
Statu and actions
Often requiring more complex mathematical modely.
6. Single agent vs moltingue 3
      Single agent -> only one agent operate in the environmen +
      moth agent > multiple agent operate, potentially competing or
                   cooperating with each other
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4. (a) Describe PEAS (2). You are designing a "shopping AI books on Internet" Agent (4). What are its PEAS (4)?

Ans.

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A) Explain PEAS
-> PEAS
   Performance measure > This is like grading how well the AD dow in
               Job we look at things like accuracy speed, efficiency,
                  and whether were out happy with is
  environment > Think of this as the As's playground it include
           Everything outside the AJ that it can instract with or
             learn from like website, data and user inputs.
  Actuators > These are the Al's harde and legs. They let the Al take
             actions in its Environment, like checking buttons, typing, or
              making duesions
  Sensors > These on the AJ's Eyes and cors. They help the AJ gather
             information from it Environment, like reading text, recognizing
             image or listening to speech
           In Simple words, PEAS heips us understand how on AI works
What it had to do its job, and how we can measure its performance
                           s mouland using 5 components what
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6) you are designing or shopping AJ book on Internet Agent what are
  ItS PEAS!
  > Whin designing a "shopping AI books on Internet" agent, we use
   the PEAS framework to define its component tree's a
    Simple breakdown.
   Performance measure
    · Adevance - Find book that match user pryerence
     · Spad > quickly find and recommends books
   · cost - Effectiveness + finds good deals and discount
  · User Satisfaction - Usis are hoppy with the recommendation
      * completion > Succentully complete purchases.
     Environment
  · online bookstores: websitu like Amazon and Barne & Noble
  *Review Sitiu > Platforms like goodicade for book range and reviews
  · Usn Interface > Ohe web viterface where user anniact with the agend
  · payment syr mm > online payment methods
  · Delivery dutails > Shipping and delivery dutails
  Actuators
  "Web browsing -> Navigatu and scothers online bookstore
  · form tilling -> Enters Search Critinio and User dutails
  · Clickerig > Scient book add them to cart and checks out
  * APJs > Fetche book information and complete transactions
  · payment procuring > Executo Secure payments.
   Scusors
  "Web Scraping > Gather data from web page about books
   Price
  · APIS -> Rentivo book information from online book story
  · Oser I npot > Collect user prycerna and Search Criteria
   · Network monitoris -) Enjure Stable internet Connections
    · payment verification > Confirm Successful transaction and orders
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5. (a) There are three missionaries and three cannibals who want to cross a river using a boat that can carry at most two people. The problem imposes certain constraints to ensure the safety of the missionaries and prevent the cannibals from outnumbering the missionaries on either side of the river at any time (10).

#### Ans.

Let's denote the sides as L (left) and R (right). Initially, the state is (3M, 3C, L).

- 1. Move 2C from L to R. New state: (3M, 1C, R).
- 2. Move 2C back from R to L. New state: (3M, 3C, L).
- 3. Move 2M from L to R. New state: (1M, 3C, R).
- 4. Move 1M and 1C from R to L. New state: (2M, 2C, L).
- 5. Move 2C from L to R. New state: (2M, 0C, R).
- 6. Move 2C back from R to L. New state: (2M, 2C, L).
- 7. Move 2M from L to R. New state: (0M, 2C, R).
- 8. Move 1M and 1C from R to L. New state: (1M, 3C, L).
- 9. Move 1M from L to R. New state: (0M, 3C, R).
- 10. Move 1C back from R to L. New state: (0M, 2C, L).
- 11. Move 2C from L to R. New state: (0M, 0C, R).

6. (a) The 8-puzzle sliding block start and goal states are given here. Using the depth-first search algorithm shows how to reach the goal state from the start state. What is the total cost (10)?

