Department of Computer Engineering

T.E. (Computer Sem VI)Assignment -1 Artificial Intelligence (CSC604)

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CO Addressed:–CSC604.1 -To conceptualize the basic ideas and techniques underlying the design of intelligent systems.

Assignment 1:

1. Explain the concept of rationality in the context of intelligent agents. How does rationality relate to the behavior of agents in their environments? Provide examples to illustrate your explanation.
2. Discuss the nature of environments in which intelligent agents operate. What are the key characteristics that define an environment, and how do they influence the design and behavior of agents? Provide examples of different types of environments and the challenges they present to agents.
3. Describe the structure of intelligent agents and the types of agents commonly used in artificial intelligence. What are the components of an agent, and how do they interact to achieve intelligent behavior? Provide examples of different types of agents and their applications in real-world scenarios.
4. Outline the process of problem-solving by searching, including the role of problem-solving agents and the formulation of problems. How do problem-solving agents analyze and approach problems, and what methods do they use to search for solutions? Illustrate your explanation with examples of problem-solving tasks and the strategies employed by agents to solve them.

Rubrics for the First Assignments:

Indicator	Average	Good	Excellent	Marks
Organization (2)	Readable with some missing points and structured (1)	Readable with improved points coverage and structured (1)	Very well written and fully structured	
Level of content(4)	All major topics are covered, the information is accurate (2)	Most major and some minor criteria are included. Information is accurate (3)	All major and minor criteria are covered and are accurate (4)	
Depth and breadth of discussion and representation(4)	Minor points/information maybe missing and representation isminimal (1)	Discussion focused on some points and covers themadequately (2)	Information is presented indepth and is accurate (4)	
Total				

Signature of the Teacher

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AI Assignment -1:

Q1) Explain the concept of rationality in the context of intelligent agents. How does rationality relate to the behaviour of agents in their environment? Provide examples to illustrate your explanation.

→ Rationality refers to the ability of an agent to make decisions that are expected to maximize its chances of achieving its goals, given the available info and resources. A rational agent is one that chooses consistently, actions that are optimal or near optimal.

Here's how rationality relates to agent behaviour:

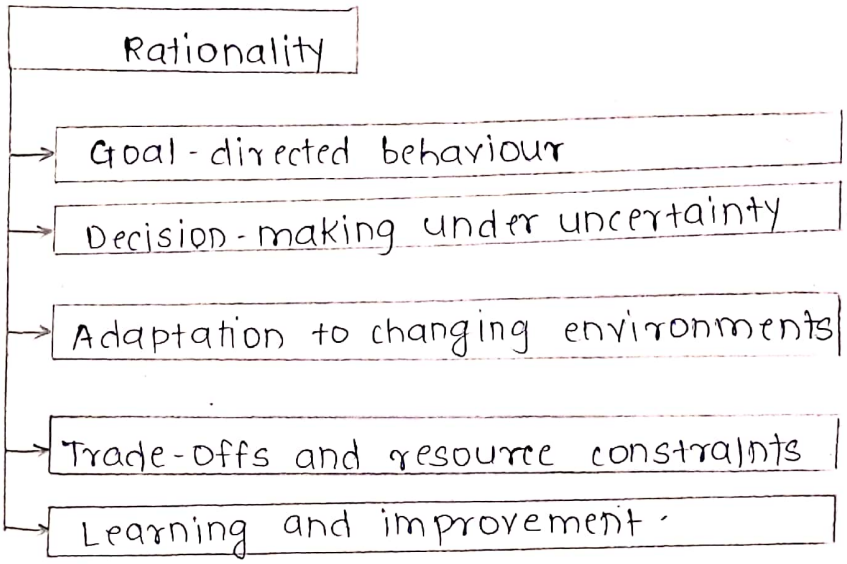
1) Goal-directed behaviour: Rational agents are driven by goals or objectives they aim to achieve. Their actions are selected based on their assessment of how likely those actions are to bring them closer to their goals.

2) decision-making under uncertainity: In many real world scenarios, agents don't have complete information about their environment or the outcomes of their action. Rational agents make decisions for weighing the available evidence and assessing the probabilities of different outcomes.

3) Adaptation to changing environments: Environments are often dynamic, and rational agents need to adapt their behaviour accordingly. This adaptation involves continuosly updating their believes and stratergies based on new information and experiences.

4) Trade-offs and resource constraints: Rational agents must often make trade-offs due to limited resources such as time, energy or computational power. They allocate resources to actions that are expected to yield the highest utility or payoff.

5) Learning and improvement: Rational agents can learn from past experiences to improve their future decision making. This learning process involves identifying patterns in data, adjusting strategies and refining their models of the environment.



Q2) Discuss the nature of environments in which intelligent agents operate. What are the key characteristics that define an environment, and how do they influence the design and behaviour of the agents? Provide examples of different types of environments and the challenges they present to agents.

→ The nature of environments in which intelligent agents operate varies widely depending on the applications domain. However, there are several key characteristics that define an environment and significantly influence the design and behaviour of agents:

characteristic	Description	Examples
Observable	whether agents have access to complete information about the state of the environment.	chess (fully observ-able), self-driving cars (partially observable).
Deterministic	whether the outcome of actions is entirely predictable or if there is randomness or uncertainty in the outcomes.	chess (deterministic), weather forecasting (stochastic).
Episodic	whether each interaction between the agent and the environment is self contained or if there is a sequence of actions and states.	chess (episodic), Maze navigation (sequential)
Dynamic	whether the environment changes over time with response to agent actions or external factors	Financial markets (dynamic), Robotics (dynamic).
Discrete	whether the state and action spaces are finite or countably infinite, cont	Board games (discrete) Robotics (continuos)

Examples of diff types of environments and challenges they present

Environment type	Example	challenges for agents.
Board games	Chess, Go	Vast search space, optimal decision making under uncertainty.
Robotics	Manufacturing floors	Sensor perception, path planning, object manipulation
Natural language processing	Text/speech	Contextual understanding, ambiguity resolution

Q3) Describe the structure of intelligent agents and the types of agents commonly used in AI. What are the components of an agent, and how do they interact to achieve intelligent behaviour? Provide examples of different types of agents and their applications in real-world scenarios

→ The typical components of an intelligent agent include:

1) Perception: This component is responsible for sensing and perceiving the environment. It gathers information from sensors, which could be physical sensors like cameras and microphones in robotics, or abstract sensors like data inputs in software agents.

2) Actuation: The actuation component enables the agent to interact with the environment. It consists of effectors, which are mechanisms through which the agent can exert control or influence its surroundigs.

3) Knowledge Base: This component stores the agent's internal representation of the world, including its beliefs, goals, plans and past experiences. The knowledge base is essential for decision-making and guiding the agents behaviour.

4) Reasoning / Decision making: The reasoning component processes information from the perception module and the knowledge base to make decisions and choose actions that are expected to achieve the agent's goals.

5) Learning / Adaptation: Intelligent agents can learn from experience and adapt their behaviour over time

Some common types of agents used in AI along with their applications:

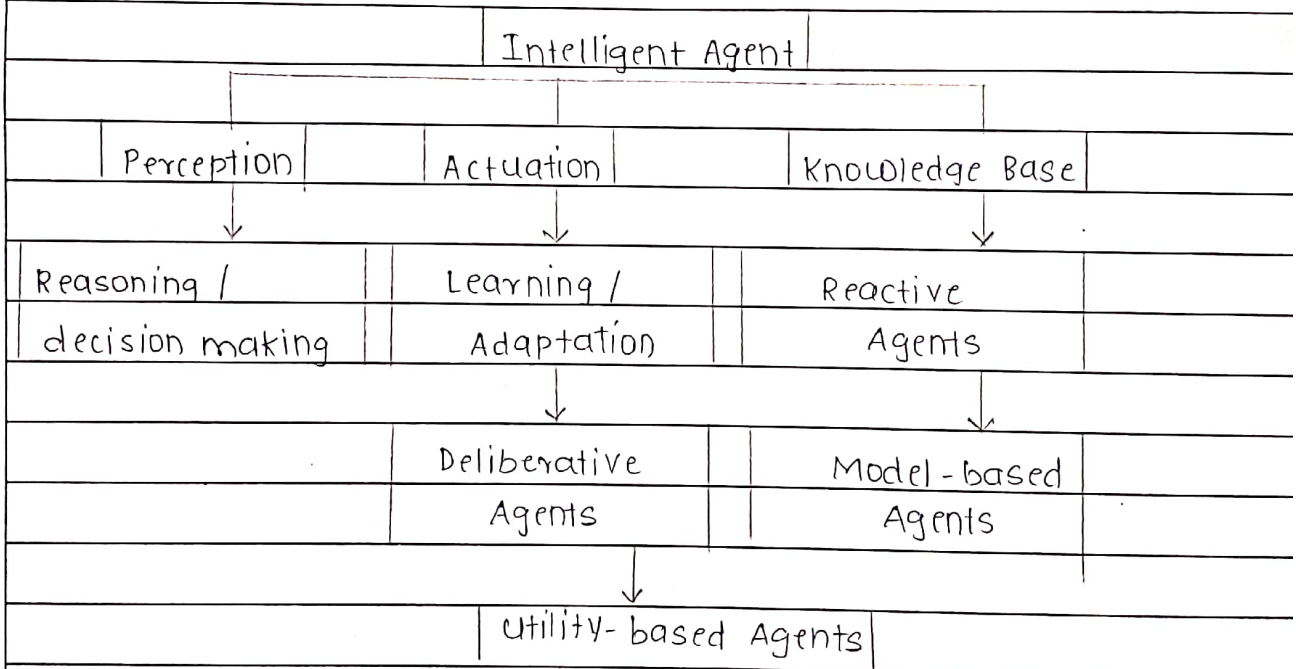
1) Reactive agents: These agents make decisions based solely on the current percept. They don't maintain an internal state or model of the.

2) Deliberate Agents : Deliberate Agents maintain an internal representation of the world and use reasoning and planning to make decisions.

3) Model-based Agents : Model-based Agents maintain an explicit model of the environment, which they use to simulate possible future states and outcomes.

4) Utility-based Agents : Utility-based Agents make decisions by evaluating the utility or desirability of different actions and selecting the one that maximizes expected utility.

5) Learning Agents : Improve their performance over time by learning from experience.



Q4) Outline the process of problem-solving by searching, including the role of problem-solving agents and the formulation of problems. How do problem solving agents analyze and approach problems, and what methods do they use to search for solutions? Illustrate your explanation with examples of problem-solving tasks and the stratergies employed by agents to solve them.

→ Outline of process of problem-solving by searching:

1) Problem Formulation: problem solving agents begin by defyning the problem they need to solve. This involves identifying the initial state, the possible actions or operaters available to the agent, the goal state or state that the agent aim.

2) Problem representation: Once the problem is formulated, problem-solving agents represent it in a suitable formalism, such as a state space, a graph, or a set of logical propositions.

3) search stratergy selection: Problem solving agents then choose a search strategy to explore the problem space and find a solution.

4) search process: begins the search process from the initial state and systematically explores the problem space by applying the chosen search strategy.

5) Solution reconstruction: Once a goal state is reached, the problem-solving agents reconstructs the solution path by tracing back through the sequence of actions or states that lead to the goal.

- Illustrative example:

1) Pathfinding in a Maze:

- Problem formulation: initial state (starting position in the maze) actions (movement in four directions - up, down, left, right) goal state (destination in the maze).
- problem representation: state space representation where each state corresponds to a position in the maze.

- search stratergy: Depth-first search or breadth-first search to explore the maze and find a path from the initial state to the goal state.
- Example solution: The agent explores the maze by moving from one position to another, avoiding obstacles, until it reaches the goal position.