

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 is minimal (1)	Discussion focused on some points and covers them adequately (2)	Information is presented in depth and is accurate (4)	
Total				

Signature of the Teacher

Assignment - 1

AI

Q1)

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 consistency, actions that are optimal or near optimal.

Here's how rationality relates to agent behavior.

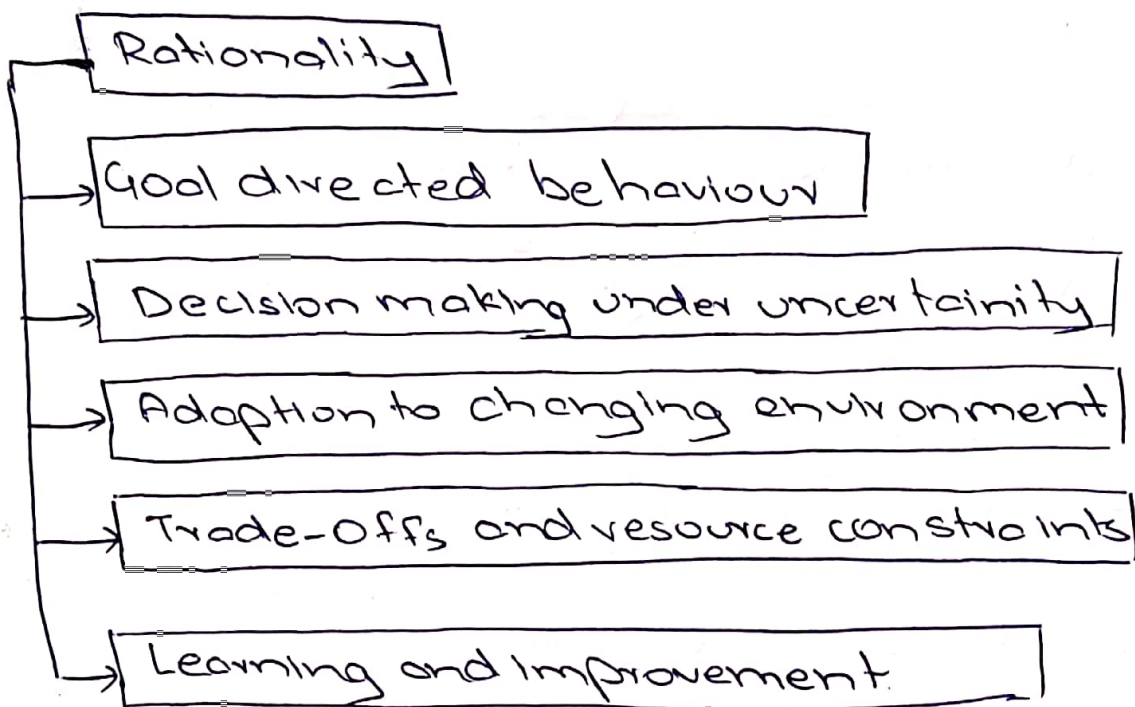
1) Goal directed behaviour. Rational agents are driven by goals or objectives they aim to achieve. Their actions are selected based on their assessment of how likely those actions are to bring them closer to their goals.

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

3) Adaption to changing environments. Environments are often dynamic and rational agents need to adapt their behaviour accordingly. This adaption involves continuously updating their beliefs and strategies based on new information and strategies.

4) Trade offs and resources constraints: Rational agents must often make trade offs due to limited resources such as time energy or expected to yield highest utility or payoff

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



Q2)

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

of agents

CHARACTERISTICS	DESCRIPTION	EXAMPLES
Observable	Whether agents have access to complete information about the state of environment	Chess (fully observable) self driving cars (partially observable)
Deterministic	Whether the outcome of action is entirely predictable or if there is randomness or uncertainty in the outcomes	Chess (deterministic) weather forecasting (stochastic)
Episode	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 count infinite	Board games (discrete) Robotics (continuous)

Examples of diff types of environments and challenges they present ~~present~~ challenges for agents.

ENVIRONMENT TYPE	EXAMPLE	CHALLENGES FOR AGENTS.
Board games	Chess, go	Vast search space, optimal decision making uncertainty
Robotics	Manufacturing floors	Sensor preception, path planning, Object manipulation
Natural language processing	Text/speech recognition	Contextual understanding, ambiguity resolution

Q3)

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 input in software agents.

2) Actuation:- The actuation component stores the agent to interact with the environment. It consists of effectors which are mechanisms through which the agent can exert control over influence its surroundings.

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

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

5) Learning/Adoption: Intelligent agents can learn from experience and adopt their behaviour over time.

Some common types of agents can learn from experience and adopt their behaviour over time.

Some common types of agents used in AI 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

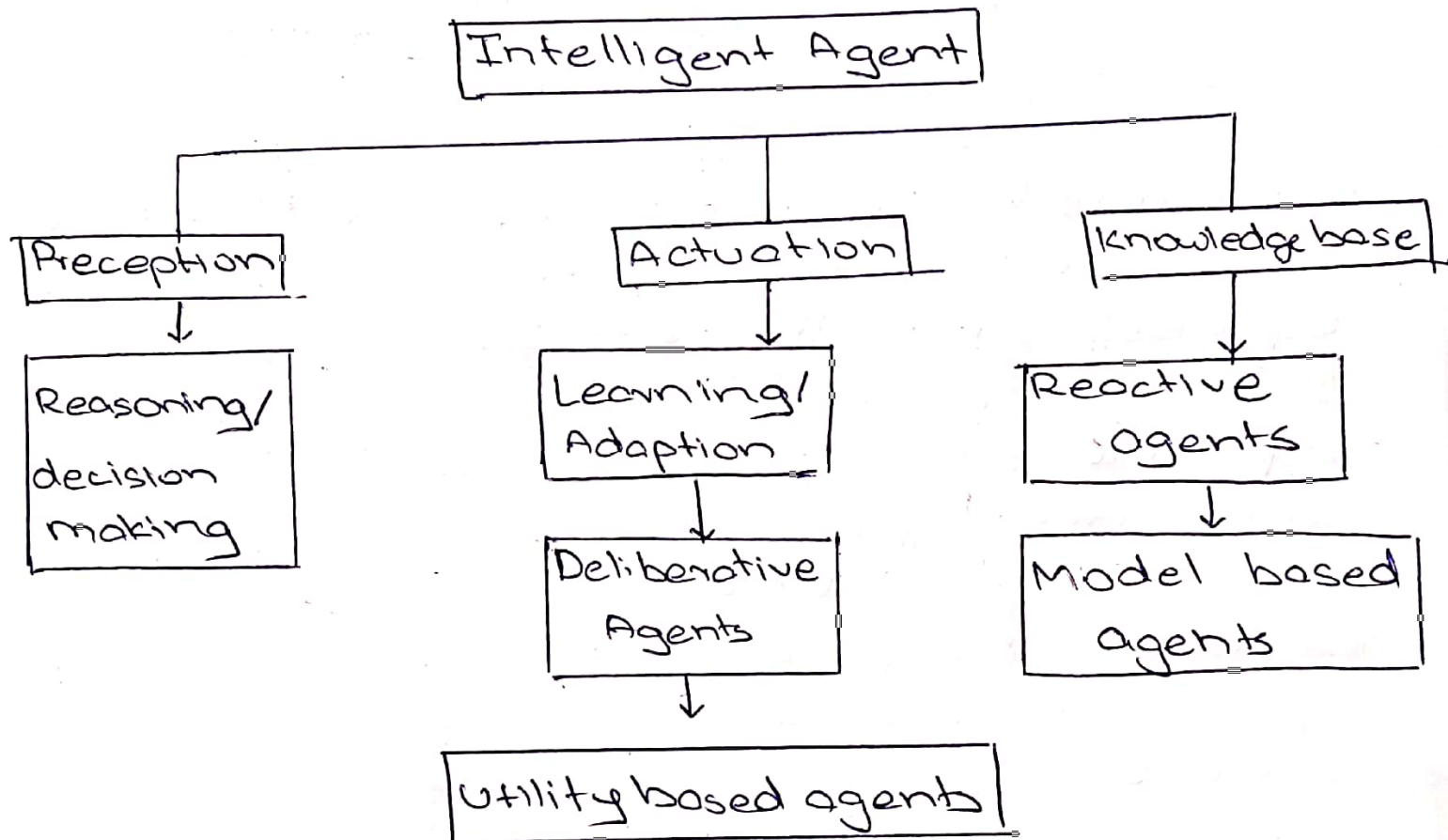
2) Deliberate agents: Deliberate agents maintain an explicit model of the environment which they use to simulate possible future states and outcomes.

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

4) Utility based agents: These 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 of process of problem solving by searching

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

2) Problem state representation: Once the problem is formulated problem solving agents represent it in

a suitable ~~noamer~~ formalism such as a state space a graph or a set of logical propositions

3) Search Strategy: 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 reconstruct the solution path by tracing back through the sequence of actions or states that lead to the goal.

Illustrative example:-

1) Path Finding in 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 strategy: Depth first search or breadth first search to explore the maze by moving from one position to another, avoiding obstacles until it reaches the goal position.

