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AI Assignment - I

Q] Explain the concept of rationality in the content of intelligent agents. How does rationality relate to the behaviours of agents in their environment? Provide examples to illustrate your explanation.

Ans] Rationality refers to the ability of an agent to make decisions that are expected to maximise its chances of achieving its goals, given the available info and resources.

Here's how rationality relates to agent behaviour:

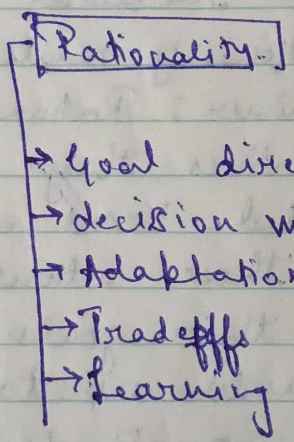
(i) Goal-directed behaviour: Rational agents are driven by goals or objectives they aim to achieve. Their actions are selected based on their assessment of how likely those actions are to bring them closer to their goals.

(ii) decision making under uncertainity: in many real world scenarios agents don't have complete information about their environment or the outcome of their action. Rational agents make decision ~~to~~ by weighing the available evidence assessing the possibilities of different outcome.

(iii) Adaptation to changing environments: Environments are often dynamic and rational agents need to adapt their behaviour accordingly. This adaptation involves continuously updating their beliefs and strategies based on new information and experience.

(iv) Trade offs and resource constraints : Rational agents must often make trade offs due to limited resources such as time, energy or computational power.

(v) 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.



Q.2 Ans]

Characteristics	Description	Examples
Observable	Whether agents have access to complete info. about the state of the environment	chess (fully observable), self driving cars (partially)
Deterministic	Whether the outcome of actions is entirely predictable or if there is randomness or uncertainty in the outcome.	chess (deterministic) weather forecasting (stochastic)

epistatic	whether each interaction between the agent and the environment is self contained or if there is a sequence of actions and states.	maze navigation.
Dynamic	whether the environments changes over time with response to agent actions or external factors.	Financial market, (dynamic), Robotics (dynamic.
Discrete	whether the state and action spaces are finite or countably infinite.	Board game (discrete) Robotics (continuous)

Examples of different environments.

Environment type	Example	Challenge for agent
Board game	Chess, go	Vast search spaces optimal decision making under uncertainty.
Robotics	Manufacturing floors	sensor perception, path planning, object manipulation.
NLP	text/ speech process	textual understanding, ambiguity resolution.

Q.3] Ans The typical component of AI agent include:

(i) Perception: This component is responsible for sensing and perceiving the environment. It gathers information from sensor like data inputs in software agent.

(ii) Actuation: The actuation component enables the agent to interact with the environment. It consists of effectors which are mechanism through which the agents can exert control or influence its surroundings.

(iii) Knowledge Base: This component stores the agents internal representation of the world, including its beliefs, goals, plan and past experiences. This knowledge base is essential for decision making and guiding agents behaviour.

(iv) 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 agents goal.

(v) 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 application:

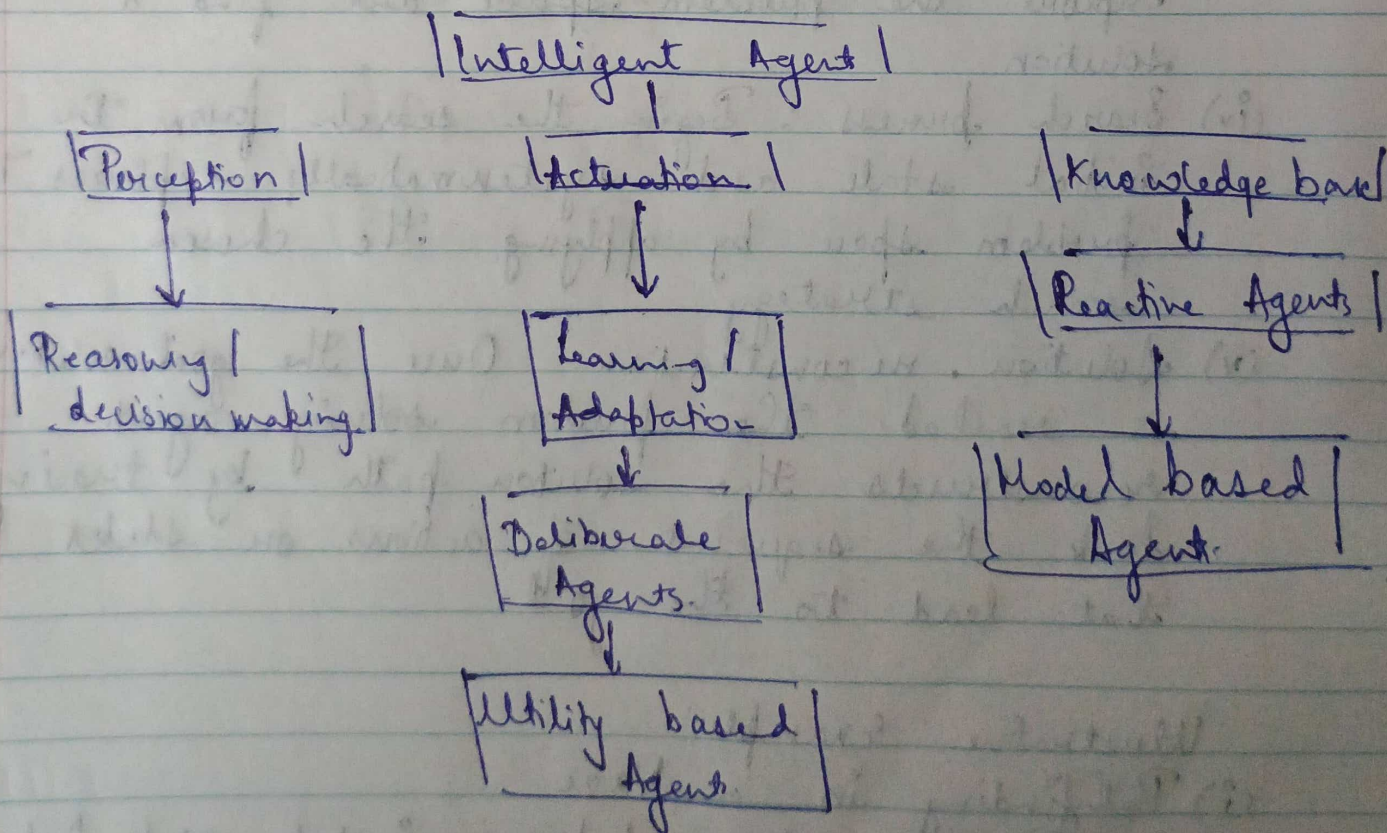
(i) Reactive Agents: These agents make decisions based solely on the current percept. They don't maintain internal state or model of time.

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

(iii) Model based agents : Model based agents maintain an explicit model of the environment which they use to simulate possible future states and out comes.

(iv) Utility based agents : Utility based agent make decisions by evaluating the utility of different action and selecting the one that maximises expected utility.

(v) Learning agents : Improve their performance one time by learning from experience.



Q.4]

Ans] Outline of process of problem solving by searching.

(i) 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, goal state or state that the agent aim.

(ii) 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 proposition

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

(iv) Search process: Begin the search from the initial state and systematically explores the problem space by applying the chosen search strategy.

(v) Solution reconstruction: Once the goal solution is reached, the problem solving agent reconstructs the solution path by tracing back the sequence of actions or states that lead to the goal.

Illustrative Example:

(i) Pathfinding in a Maze:

- Problem formulation: initial state (starting position in the maze) action (movement in four direction - up, down, left, right) goal state (destination in the maze)

- search strategy : Depth first search or breadth 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.