ASSIGNMENT - 1

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

1) Rationality refers to the ability of an agent to make decisions that maximize its expected ability or achieve its goals given the available information and resources.

2) Rationality is about making the best possible decisions given the circumstances even if those decisions are not always perfect.

3) Rationality relates to the behaviour of agents in the environments by guiding them to select actions that lead to desirable outcomes or goals.

4) An agent is considered rational if it consistently chooses actions that are expected to maximize its utility or achieve its objectives.

5) Examples: A chess playing agent would choose moves that are expected to lead to victory or at least avoid defeat. It evaluates potential moves based on its understanding of the game state and selects the one that maximizes its chances of winning.

2) In a self driving car rationality involves making decisions that prioritize safety and efficiency. The car must navigate through traffic, obey traffic laws and avoid accidents all while reaching its destination in a timely manner. A rational self-driving car would choose routes and driving

behaviours that minimize the risk of accidents and optimizing travel time.

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

1) The nature of environments in which intelligent agents operate is diverse and can vary greatly depending on factors such as complexity, dynamics, observablity, determinicism and episodicity.

1) Complexity:- Environments can range from simple deterministic environments with a few states and actions to complex statastic environments with countless possible states and actions.

2) Dynamics:- Environments may be static, when the agents actions do not change the state or dynamic, where the environment evolves even without the agents intervention.

3) Observability:- Environments can be fully observable where the agents has access to complete information about the current state & partially observable where the agent has limited or incomplete information.

4) Determinism:- Environments may be deterministic, where the outcome of an action is fully determined by current state and the action takes or stachastic where there is an certainaty in outcome.

5) Episodicity : Environments may be episodic where each action leads to an immediate reward and resets the environment to an initial state or sequential where actions taken now can affect future states and rewards.

Examples :- Stock Market:

A stochastic partially observable sequential environments with high complexity. Agents may analyz historical data, predict future market movements and adapt their strategies in the real time to changing conditions.

2) Robot Navigation: A dynamic observable sequential environment with moderate complexity. Agents need to perceive their sourroundings through sensors, plan rajecteries to navigate obstacles and updates their plans as new information becomes available.

3) Describe the structure of intelligent agents and the types of agents commonly used in artifical intelligence what are the componets of an agent and how do they intract to achieve intelligent behaviour? Provide example of different types of agents and their application in real world scenarios.

1) Intelligent agents in artificial intelligence typically consist of five main components.

i) Perception:- This component involves sensing the environment using sensors to gather information. Its about how an agent perceives its surroundings.

2) Reasonings - Agents use reasoning mechanism to make decisions and plan actions based on information they have gathered. This involves processing and analyzing data to come up with solutions or responses.

3) Actuation :- Once a decision is made the agent must act of to upon it. Actuators are mechanisms through which the agent interacts with environment to carry out actions

4) Knowledge :- Agents posses knowledge or information about the environment, themselves and the tasks they need to perform. This knowledge can be pre-defined, learned or inferred from past experiences.

5) Learning! - Intelligent agents can improve their performance over time through learning mechanisms. This could involve acquiring good knowledge adapting strategies or optimize behaviour based on feedback.

Types of intelligent agents include

1) simple reflex agents: these agents take actions based solely on a current percept without considering the history of past percepts. An example is a thermostat that adjusts the temperature based on current readings

2) Model Based Reflex Agents. they maintain an internal model of an environment and use it to make decisions for example a vaccum cleaning robot that uses a map of room to decide where to clean next.

3) Goal Based Agents :- These agents have goals or objectives that they aim to achieve and take actions to move towards these goals. An example is a delivery drone that navigates to deliver packages to specific locations.

4) Utility Based agents:- They evaluate the desireability of various actions based on a utility functions and choose the action that maximizes expected utility A personal assistant apt that schedules tasks based on user preferences and priorities is an example

5) Learning Agents:- These agents improve their performance over time through learning from experience. Examples include recommendation systems that learn user preference from interactions and adapt their recommendations accordingly.

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 strategies employed by agents to solve them

A Role of problem-solving agents

1) Problem-solving agents operate independently making decisions and taking actions to achieve without human intervention.

2) These agents are designed to efficiently explore and navigate problem spaces to find optimal or satisfactory solutions.

3) Problem-solving agents can adopt to changes in their environment or problem domain adjusting their strategies

accomodate new information of new constraints.

4) They can handle a wide range of problem types and complexities from simple puzzles to complex real world scenarios

2) Formulation of problems.

1) Problem formulation involves abstracting real world scenarios into a formal representation that can be understood and processed by problem-solving agents.

2) Problems are represented in a way that captures essential elements such as intial states, goal states actions and constraints

3) Formulating problems provides a structural approach to problem-solving, braking down complex issues into smaller more manageable components.

③ Methods used for searching solutions:-

1) Uninformed Search: Agents explore the problem space systematically without consideration of domain specific knowledge.
eg Breadth first search, depth first search

2) Informed search Agents use domain specific knowledge or heuristics to guide the search towards promising solutions
Eg A* Search, greedy best first search

3) Local Search agents - Agents iteratively improve candidate soultions by making small modifications.

4) Examples.

1) Routing Planning :- In navigation systems, problem-solving agents search for the shortest path between two locations
no -pray.

and they analyze the road network consider traffic conditions and employ algorithms like to find optional routes.

2) Puzzle solving : In games like Sudoku or Rubik's cube agents aim to find soultion satisfying certain constraints They analyze the puzzles initial state explse possible moves and use strategies like constant propagation or back tracking to slove the puzzle.

3) Automated planning :- In robotics or automated systems problem solving agents plan sequences of actions to achieve desired outcomes they analyze the environment consider constraints and employ planning algorithms like POSC to generate action sequences.