Roll no - 9562
Name - Shreya Panikkassery

AI - Assignment - 1

Q.1 1) Rationality refers to the ability of an agent to make decisions that maximize its expected utility or achieve its goals given the available information and resources. It encompasses the idea of making optimal choices based on the available evidence and the agent's preferences.

2) Rationality is about making the best possible decisions given the circumstances even if those decisions are not always perfect. 3) Rationality ~~refers~~ relates to the behaviours 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 consistency chooses actions that are expected to maximize its utility or achieve its objectives.

5) Eg : 1) A chess-playing agent - A rational 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.

Q.2) 1) The nature of environments in which intelligent agents is diverse and can vary greatly depending on factors such as complexity, dynamics, observability, determinism and episodicity.

a) Complexity - Environments can range from single deterministic environments with a few states and acti...

to complex environments with countless possible states and actions.

3) Dynamics - Environments may be static, where the agents actions do not change the state or dynamic, where the environment evolves even without the agent's intervention.

3) Observability - Environments can be fully observable where the agents has access to complete information about the current state or 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 taken or stochastic where there is uncertainty in ~~or~~ 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: 1) Stock Market:
A stochastic partially observable sequential environment with high complexity. Agents may analyze historical data, predict future market movements and adapt their strategies in real-time to changing conditions.

2) Robot Navigation - A dynamic observable sequential environment with moderate complexity. Agents need to perceive their surroundings through sensors, plan trajectories to navigate obstacles & update their plans as new information becomes available.

Q3) 1) Intelligent agents in artificial intelligence typically consist of five main components.

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

b) 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.

c) Actuation: Once a decision is made, the agent must act upon it. Actuators are mechanisms through which the agent interacts with environments to carry out actions.

d) Knowledge: Agents posess 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.

e) Learning: Intelligent agents can improve their performance over time through learning mechanisms. This could involve acquiring good knowledge adapting steatgies or optimizes behaviour based on feedback.

Types of intelligent agents include:

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

2) Model Reflex Agents - They maintain an internal model of an environment and use it to make decisions. For example, a vaccuum cleaning robot that uses a map of room to decide where to clean next.

3) Goal Based agents - They 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 delive packages to specific locations

4) Utility based agents: They evaluate the desirability of various actions based on utility function and choose the action that maximises expected utility.

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

Q.4)

A) Role of problem solving agents.

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

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

3) Problem solving agents can adapt to changes in their environment or problem domain adjusting their strategies to accomodate new information or new constraints.

4) They can handle a wide ~~from~~ range of problem types & complexities.

B) 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 initial states, goal states action and constraints.

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

C) Methods used for searching solutions:

1) Uninformed search: Agents explore the problem space systematically without consideration of domain specific knowledge.

eg: BFS, DFS

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

D.) Examples:

1.) Routing Planning: In navigation systems, problem-solving agents search for the shortest path between two locations 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 solutions satisfying certain constraints. They analyze the puzzles initial state explore possible moves and use strategies like constant propagation or backtracking to solve the puzzle.