

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 may be 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				

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Signature of the Teacher

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ASSIGNMENT-1

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

Ans ① Rationality refers to the ability of an agent to make decisions that maximize its expected utility or achieve its goals given the ~~an~~ 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.

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.

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 optimize 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 present to agents

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

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

② Dynamics - Environments may be static, where the agents' actions do not change the state or dynamic, where the environment evolves ~~when~~ even without the agent's intervention

③ Observability:- Environments can be fully observable where the agent 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 outcome

⑤ Episodic:- 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 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 and updates their plans as new information becomes available

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 behaviour? Provide examples of different types of agents and their applications in real world scenarios

① Intelligent agents in artificial intelligence typically ~~be~~ 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 Reasoning:- Agents use reasoning mechanism ~~to~~ 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~~ act upon it. Actuators are mechanisms through which the agent interacts with environment to carry out actions
- ④ Knowledge:- Agents possess 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 optimizing 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 ~~th~~ model of an environment and use it to make decisions for example, a vacuum cleaning robot that uses a map of room to decide where to clean next
- ③ Goal Based ~~Any~~ 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 desirability of various actions based on a utility function and choose the action that maximizes expected utility. A personal assistant app 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 preferences from interactions and adapt their recommendations accordingly.

(24) 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 desired goals without human intervention.
- ② These agents are designed to efficiently explore and navigate problem spaces to find optimal or satisfactory problems solutions.
- ③ Problem-solving agents can adapt to changes in

their environment or problem domain ~~adjusting~~ adjusting their strategies to accommodate new information or new constraints

(1) 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 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

(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 solutions by making small modifications

(4) 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 A* to find optimal routes

(2) Puzzle solving: In games like Sudoku or Rubik's cube agents aim to find solutions satisfying certain constraints. They analyze the puzzle's initial state, explore possible moves, and use strategies like constraint propagation or backtracking to solve 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 PDDL to generate action sequences.