

Department of Computer Engineering

T.E. (Computer Sem VI) Assignment -1 Artificial Intelligence (CSC604)

Student Name: Royce Robert Dmello Roll No: 9533

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

Artificial IntelligenceAssignment 1

Q1.) i) In artificial intelligence (AI) and machine learning, a rational agent is a theoretical entity that models how intelligent beings think and make decisions.

ii.) A rational agent is characterized by:
Preference: It considers advantageous and aims to achieve its goals.
Learning ability: It can adapt and learn from experience.

iii.) A rational agent uses a set of rules or algorithms to determine the best course of action in a given situation.

iv.) For example:

When you're hungry, you decide to eat something. If you're no longer hungry, you stop eating. A rational agent follows a similar decision-making process.

v.) Examples of rational agents

a.) Self-driving cars

These vehicles use sensor data to make decisions. They optimize for safety and efficiency by considering road conditions, traffic, and pedestrian movements.

b.) Game playing

These agents follow game rules and analyze the current state of the board.

They aim to maximize their chance of winning.

c.) virtual personal Assistant
These agents understand natural language commands.
They take appropriate action based on request.

d.) stock trading Algorithm
These agents analyze market data and predict future performance.
They make buy/sell decision to optimize returns.

Rationality is central to AI because it helps us to create intelligent systems that mimic human decision-making.

Q2.) Discuss the nature of environment in which agent operate. What are the key characteristics that define an environment and how do they influence the design and behaviour of an agent?
→ The nature of environment in which intelligent agent operate and how the environment influence agent design and behaviour.

Key characteristics of environments include:
i) observability: Whether an agent can fully perceive the environment or only partially. In a fully observable environment, the agent has complete information about the state of the environment. In a partially observable environment, the agent only receives partial information, which presents challenges for decision-making.

ii) Determinism: Whether the environment behaviour is predictable or stochastic. Deterministic environments follows fixed rules while stochastic ones introduce uncertainty.

iii) Static vs Dynamic: Static environments remain unchanged during an agent decision-making process, while dynamic environments change over time.

iv) Discrete vs Continuous: Discrete environments have distinct states and actions while continuous ones involve continuous variables.

v) Single Agent vs Multi-Agent: Single-agent environments involve only one agent, while multi-agent environments have multiple interacting agents.

Examples of Different Environments

- Chess Game (fully observable, deterministic, sequential)

The chessboard is fully observable.

The rules are deterministic.

The game is sequential, with each move affecting subsequent moves.

Challenges: The branching factor is high, requiring efficient search algorithms.

vi) Environment characteristic guide agent sensors: Agent needs appropriate sensors.

vii) Designing intelligent agent involves understanding these characteristics and tailoring the behaviour accordingly.

Q3) Describe the structure of intelligent agent. the type of agents commonly used in artificial intelligence. what are the components of agent and how do they interact to achieve intelligent behaviour? provide examples of types of agent and their application in real world.

→ These agents play a crucial role in performing action to achieve specific goals. a breakdown of their structure and components.

Structure of Intelligent Agent

1) Architecture

The architecture represents the machinery on which the agent operates. It includes sensors and actuators.

Example of architecture include

A robotic car equipped with camera and

A PC with input devices and output devices.

2) Agent program

The agent program implements the agent function. It maps the percept sequence to an action.

In other words Agent = Architecture + program.

3) PEAS model

The PEAS model defines an agent based on its components.

performance Measure: The criteria for evaluating the agent's success.

Environment: The context in which the agent operates.

Actuators: The mechanisms through which the agent interacts with the environment.

Sensors: The sensors that perceive the environment.

Types of Intelligent Agents:

1.) reactive Agent

These agents respond to immediate stimuli from the environment.

They don't maintain an internal state or plan ahead.

Example: Intelligent personal assistant like Siri, Alexa and Google Assistant.

2.) proactive Agents

Proactive Agents plan ahead to achieve their goals.

They consider past and current information to make decisions.

Example: Driverless car.

3.) Software Daemons:

These agents monitor software environments and modify them based on changing conditions.

Example: The UNIX xinetd program which alerts users about incoming email.

5.) process control system

These agents monitor real-world environments and take action to modify them.

Example: A thermostat adjusting room temperature based on sensor reading.

Real-world Applications

1.) Robotics

- Robots in factories, warehouses and homes
- Industrial automation for assembly

2.) Gaming

- Non-player characters in video games
- AI opponents in chess, Go and other games

3.) Intelligent System

- Recommendation system
- Traffic management in smart cities

Q4.) outline the process of problem-solving including the role of problem-solving the formulation of problem. How do problem-solving agents analyze and approach problems? What methods do they use to search for solutions? → problem solving by searching in the state space of AI. problem solving agent play a role in finding solutions to various problems.

Problem Solving Agents

1.) Goal formation

Agents start by defining their goal and aim to achieve it.

for eg: Imagine being on holiday in London (A) and needing to reach Bucharest (B) by flight.

2.) problem formation

Agents represent the problem in terms of states and actions.

States: Represent various situations.

Action: Define legal transitions between states.

Examples in the travel scenario, cities as state and driving between cities is an action.

3) Search process

Agents explore a search tree or graph to find a solution.

Solution are sequence of action leading from the start state to goal state.

Example: The agent searches for the sequence cities (Arod, Sibiu, Iagazas, Bucharst)

4) Execution

once the solution is found, the agent performs recommended actions.

Example: Traveling in Romania

Informal Description: you're on holiday in Romania currently in Arod, your flight leaves from Bucharst tomorrow.

Goal: Be in Bucharst

States: various cities

Initial State: Arod

Solution: A sequence of cities leading from Arod to Bucharst

Strategies Employed by Agents

1.) Uniformed Search Strategies

• Bread first search: Explore all neighbours deeper levels.

Uniform-cost search: Consider paths with lowest cumulative cost.

Depth-first search: Explore as far as possible along one branch before backtracking.

Teacher's Signature:

Deep Limited search and Iterative Deepening:
 Combines depth first search with depth limit
 Informed search strategies:

Greedy search: prioritizing state that appear
 closest ~~with~~ to the goal.

Heuristic functions: use domain specific
 knowledge to estimate the cost to reach the
 goal.

Teacher's Signature:.....