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Internal Assessment Test 1 – October 2024

Sub:	Introduction to AI & ML					Sub Code:	21CS752	Branch:	ECE	
Date:	15/10/24	Duration:	90 minutes	Max Marks:	50	Sem/Sec:	VII		OBE	

		Answer any FIVE FULL Questions	MARKS	CO	RBT
1		Compare and contrast the definitions of Artificial Intelligence from the following point of views: Thinking Humanly, Acting Humanly, Thinking Rationally and Acting Rationally.	[10]	01	L3
2	a	What is the Turing test?	[5]	01	L2
	b	What are the capabilities a computer must possess to meet the Turing test.	[5]	01	L2
3	a	Define the following terms with respect to an intelligent agent: 6/CO1/ (L1) (i) Agent, (ii) Environment, (iii) Sensors, (iv) Actuators, (v) percepts, percept sequence, (vi) Agent functions, agent programs	[6]	1	L1
	b	Define a rational agent.	[4]	1	L1
4	a	Write the algorithm for Breadth-first search on a graph.	[10]	1	L2
5	a	Compare and contrast four types of agent programs?	[10]	1	L2
6	a	Explain PEAS.	[4]	1	L2
	b	You are designing a “shopping AI books on Internet” Agent. What are its PEAS?	[6]	1	L4

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Solution

1. Ans- 1 Thinking Humanly (Cognitive Perspective)
    - **Definition**: AI is concerned with mimicking human thought processes. This perspective focuses on replicating human cognition, including perception, reasoning, memory, and problem-solving.
    - **Key Idea**: AI is designed to think like a human, attempting to simulate the internal cognitive processes humans use to solve problems and make decisions.
    - **Example**: Cognitive AI systems like natural language processing (NLP) or neural networks that simulate human reasoning.
    - **Strengths**: Provides a close connection to human intelligence; useful in domains like psychology and neuroscience.
    - **Challenges**: Understanding and replicating the full complexity of human cognition is difficult and may not always lead to efficient AI solutions.
2. **Acting Humanly (Behavioral Perspective)**
    - **Definition**: This perspective defines AI by how well it mimics human behavior. AI systems are evaluated based on whether they can perform tasks in a way that appears human-like, regardless of how they arrive at those actions.
    - **Key Idea**: AI must act like a human to be considered intelligent, with a focus on external behavior and interaction with the environment.
    - **Example**: A chatbot that interacts with users in a conversational way, or robots performing tasks like cooking or cleaning like a human.
    - **Strengths**: Provides practical and observable criteria for AI systems; useful in applications like robotics and human-computer interaction.
    - **Challenges**: Acting like a human doesn't necessarily mean the system understands the actions it performs. The system may exhibit human-like behaviors but lack true intelligence.
3. **Thinking Rationally (Logical Perspective)**
    - **Definition**: AI is viewed as the process of thinking logically and following formal rules of reasoning. Rational thinking is characterized by processing information in ways that lead to the best decisions or outcomes.
    - **Key Idea**: AI should make decisions based on logic and reason, seeking optimal solutions using formal methods like logic, algorithms, and decision theory.
    - **Example**: Expert systems, where AI uses rules to reason and derive conclusions based on available data.
    - **Strengths**: Rational thinking is grounded in formal logic and is often more predictable than human-like behavior. It is ideal for tasks requiring precise reasoning, like in medical diagnoses or legal analysis.
    - **Challenges**: Rational thinking may not always align with human values or emotions. Moreover, real-world problems are often too complex to be solved by strictly logical methods.
4. **Acting Rationally (Goal-Oriented Perspective)**
    - **Definition**: This view defines AI based on its ability to achieve specific goals effectively. An AI system is rational if it acts in a way that maximizes its chances of achieving a goal, given the available information and resources.
    - **Key Idea**: Rational action is goal-driven, meaning that AI focuses on optimizing outcomes, regardless of how human-like or logical the process might seem.
    - **Example**: Self-driving cars, where the system acts in a way that maximizes safety and efficiency by interpreting data and taking actions accordingly.
    - **Strengths**: Focused on practical, measurable outcomes. It is highly relevant to autonomous systems that require adaptive and goal-directed behavior.
    - **Challenges**: Rational actions may not always appear human-like or may even seem unconventional, especially in complex, unpredictable environments.

Key Differences

- **Thinking Humanly vs. Acting Humanly**: "Thinking Humanly" is about replicating internal cognitive processes, while "Acting Humanly" focuses on observable external behaviors that mimic human actions.
- **Thinking Rationally vs. Acting Rationally**: "Thinking Rationally" concerns logical reasoning and deriving optimal solutions, whereas "Acting Rationally" focuses on achieving specific goals through rational actions, regardless of the underlying process.

Conclusion

While the different perspectives offer valuable insights into AI, each has its strengths and limitations. "Thinking Humanly" and "Acting Humanly" emphasize human-like qualities, but they may not lead to practical or efficient AI systems. "Thinking Rationally" and "Acting Rationally" focus more on optimal problem-solving and goal achievement, which can be applied in real-world scenarios where human-like reasoning or behavior may not be necessary.

Ans-2 (a) The **Turing Test**, proposed by the British mathematician and computer scientist **Alan Turing** in 1950, is a method for determining whether a machine can exhibit intelligent behavior indistinguishable from that of a human.

Description of the Turing Test

- **Setup**: The test involves three participants:
    1. A **human interrogator**.
    2. A **human respondent**.
    3. A **machine respondent**.

The interrogator is separated from the other two participants and interacts with them via text-based communication to prevent physical or vocal cues from influencing the judgment.

- **Goal**: The interrogator's task is to determine which participant is the machine and which is the human, based solely on the responses to questions posed during the conversation.
- **Success Criterion**: If the machine can respond in a way that causes the interrogator to consistently fail to distinguish it from the human, the machine is said to have passed the Turing Test and demonstrated a form of **artificial intelligence**.

Ans- 2(b) To meet the criteria of the Turing Test, a computer must exhibit the following capabilities:

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1. Natural Language Processing (NLP)

- The computer must understand and generate **natural language** to engage in meaningful and coherent text-based conversations.
- **Key Tasks**:
    - Interpret and respond to questions and statements with relevant, contextually appropriate answers.
    - Handle ambiguities, slang, idioms, and nuanced language to sound human-like.

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2. Knowledge Representation

- The machine must have access to a broad base of knowledge and the ability to represent and recall information effectively.
- **Key Tasks**:
    - Store facts, understand relationships, and retrieve information when needed.
    - Display common sense reasoning, such as knowing that "water is wet" or "the sky is usually blue."

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3. Reasoning and Problem-Solving

- The computer must demonstrate logical thinking and the ability to solve problems or infer conclusions from the information provided.
- **Key Tasks**:
    - Deduce answers to questions based on available data.
    - Exhibit logical consistency in arguments and explanations.

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4. Learning Ability (Optional but Valuable)

- The ability to adapt and learn over time can improve a machine's conversational skills and help it perform better in the test.
- **Key Tasks**:
    - Understand patterns in conversations to refine responses.
    - Update its knowledge base to stay relevant.

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5. Emotional Intelligence

- The machine must mimic emotional understanding to engage in natural, human-like interactions.
- **Key Tasks**:
    - Recognize and respond appropriately to emotions expressed in text (e.g., empathy for sadness or humor for jokes).
    - Simulate emotional expressions when appropriate.

---

6. Context Awareness

- The machine must maintain context in an ongoing conversation to avoid irrelevant or disjointed responses.
- **Key Tasks**:
    - Track the flow of dialogue and refer back to previous statements or topics when needed.
    - Avoid repetitive or nonsensical responses.

---

7. Flexibility and Creativity

- The computer must handle unexpected or abstract questions and provide creative or plausible responses.
- **Key Tasks**:
    - Engage in open-ended discussions (e.g., "What is your opinion about art?").

- Respond intelligently to hypothetical or absurd scenarios.

---

8. Speed of Response

- The machine must generate responses quickly enough to sustain a natural conversational rhythm.
- **Key Tasks**:
  - Process input and formulate output efficiently.
  - Avoid delays that might reveal its non-human nature.

Conclusion

To pass the Turing Test, a computer must exhibit a combination of advanced linguistic, cognitive, and reasoning abilities. It doesn't need to possess true "intelligence" or consciousness but must convincingly simulate these traits to be indistinguishable from a human in conversation.

Ans- 3(a)

(i) Agent

- An **agent** is an entity that perceives its **environment** through **sensors** and acts upon it using **actuators** to achieve specific goals or objectives.
- Example: A robot vacuum cleaner perceives dust on the floor and moves to clean it.

(ii) Environment

- The **environment** is the external world or context in which an agent operates. It includes all the conditions, objects, and dynamics that the agent interacts with.
- Example: For a self-driving car, the environment includes roads, traffic signals, pedestrians, and other vehicles.

Definitions of Terms Related to an Intelligent Agent

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(iii) Sensors

- **Sensors** are the mechanisms or components an agent uses to perceive its environment. They gather input or data that informs the agent's decisions.
- Example: A robot may have cameras, proximity sensors, and touch sensors to perceive its surroundings.

(iv) Actuators

- **Actuators** are the components that enable an agent to take actions in the environment based on its decisions. They implement the agent’s chosen actions.
- Example: A robotic arm uses motors (actuators) to manipulate objects.

(v) Percepts and Percept Sequence

- **Percepts**: The information or data the agent perceives at a specific moment through its sensors.
- **Percept Sequence**: The entire history of all percepts the agent has received so far. This sequence influences the agent's decision-making process.
- Example: For a thermostat, a single percept could be the current temperature, while the percept sequence is the record of all temperature readings over time.

Ans- 3(b) An agent is considered rational if it selects an action AAA, based on percept sequence PPP, such that:
A=arg maxa∈ActionsE[Performance(a|P,K)]A = \text{arg max}_{a \in Actions} E[Performance(a | P, K)]A=arg maxa∈ActionsE[Performance(a|P,K)]
Where:

- EEE: Expected value of performance.
- ActionsActionsActions: Set of all possible actions.
- KKK: Knowledge about the environment.

Examples of Rational Agents

1. **Spam Email Filter**: Classifies emails as "spam" or "not spam" based on past data to reduce user annoyance.
2. **Autonomous Drone**: Selects optimal flight paths to deliver packages safely and efficiently.
3. **Thermostat**: Adjusts temperature based on current room conditions and target preferences.

In essence, a rational agent is one that makes decisions to **maximize utility** or achieve its objectives effectively and efficiently, given the circumstances.

You said:

Define a rational agent

ChatGPT said:

ChatGPT

Ans- 4(a) Algorithm for Breadth-First Search (BFS) on a Graph

The Breadth-First Search (BFS) algorithm explores a graph layer by layer, starting from a given source node. It uses a queue data structure to keep track of the vertices to be explored.

Inputs

- **A graph G=(V,E)G = (V, E)G=(V,E), where VVV is the set of vertices and EEE is the set of edges.**
- **A starting vertex s∈Vs \in Vs∈V.**

Outputs

- **A traversal order of the graph's vertices.**
- **(Optional) Shortest path from the source sss to all reachable vertices in terms of the number of edges.**

Ans- 5(a)

Agent Type	Definition	Advantages	Limitations
1. Simple Reflex Agents	Act based solely on the **current percept**, using a set of **condition-action rules** (if-then rules).	- Fast and straightforward. - Suitable for fully observable environments.	- Cannot handle partially observable environments. - Lack memory and adaptability.
2. Model-Based Reflex Agents	Maintain an **internal state** (a model) to track aspects of the world that are not directly observable.	- Can handle partially observable environments. - Better decision-making compared to simple reflex agents.	- Limited to environments where simple models are sufficient. - Cannot consider long-term goals.
3. Goal-Based Agents	Take actions to achieve specific **goals**, considering both the current state and the desired future state.	- Flexible and adaptable. - Suitable for dynamic and complex environments.	- May require significant computational resources for planning. - Actions may not always be optimal.
4. Utility-Based Agents	Maximize a **utility function** (a measure of "happiness" or performance) to make the most effective decisions.	- Produces optimal actions. - Handles trade-offs between conflicting objectives effectively.	- Requires designing a utility function, which may be complex. - Computationally expensive.

Ans-6 (a) **Components of PEAS**

1. **Performance Measure**:
   - Defines the criteria for evaluating the success of the agent's actions.
   - Example:
     - For a self-driving car: Safety, fuel efficiency, speed, and passenger comfort.
     - For a spam email filter: Accuracy in detecting spam and minimizing false positives.
2. **Environment**:
   - Represents the context or surroundings in which the agent operates. It includes all external factors the agent interacts with.
   - Example:
     - For a vacuum-cleaning robot: Rooms with dirt, furniture, walls, and other obstacles.
     - For a stock-trading agent: Market data, news, and economic indicators.
3. **Actuators**:
   - The components that allow the agent to take actions in the environment to achieve its objectives.
   - Example:
     - For a robotic arm: Motors to move the arm and grippers to pick up objects.
     - For a chatbot: Text generators to respond to users.
4. **Sensors**:
   - The mechanisms or tools used by the agent to perceive its environment. Sensors collect the data necessary for decision-making.
   - Example:
     - For a self-driving car: Cameras, LiDAR, GPS, and speedometers.
     - For a weather-predicting agent: Temperature, humidity, and pressure sensors.

Example Applications of PEAS Framework

1. Self-Driving Car

- **Performance Measure**: Safety, minimizing travel time, fuel efficiency, passenger comfort.
- **Environment**: Roads, traffic, pedestrians, weather conditions.
- **Actuators**: Steering wheel, accelerator, brake, signals, horn.
- **Sensors**: Cameras, radar, LiDAR, GPS, speedometer.

2. Vacuum-Cleaning Robot

- **Performance Measure**: Amount of dirt cleaned, battery efficiency, area covered.
- **Environment**: Floors, furniture, walls, dirt, obstacles.
- **Actuators**: Wheels for movement, brushes, suction motor.
- **Sensors**: Dirt sensors, bump sensors, proximity sensors.

3. Chatbot

- **Performance Measure**: Accuracy of responses, user satisfaction, conversation fluency.
- **Environment**: User input (text or voice), conversation context.
- **Actuators**: Text or voice response generator.
- **Sensors**: Input parser, Natural Language Processing (NLP) tools.

Importance of PEAS

- **Systematic Design**: Helps in breaking down the design of intelligent agents.
- **Domain-Specific Clarity**: Adapts to different environments and goals.
- **Evaluation**: Establishes clear performance criteria for assessing agent success.

The PEAS framework is a foundational tool for understanding and designing intelligent agents in AI.

Ans-6(b) This agent is designed to browse online stores, find relevant AI books based on user preferences, compare prices, and make purchases. Below is the detailed PEAS framework:

---

1. Performance Measure (P)

The criteria used to evaluate the success of the agent:

- **Relevance**: Finds books matching the user's preferences (e.g., topic, author, or price range).
- **Cost-effectiveness**: Minimizes the total cost (book price + shipping).
- **Speed**: Completes the search and purchase quickly.
- **Accuracy**: Avoids incorrect or irrelevant purchases.
- **User Satisfaction**: Meets or exceeds user expectations regarding book selection.

---

2. Environment (E)

The context in which the agent operates:

- **Websites**: Online bookstores (e.g., Amazon, Flipkart, etc.), publisher websites, or second-hand book platforms.
- **User Preferences**: Information provided by the user (e.g., topics of interest, price range, preferred authors).
- **Dynamic Information**: Real-time data such as availability, discounts, shipping options, and user reviews.
- **Internet**: A connected environment that may have slow loading pages or downtime.

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3. Actuators (A)

The components that allow the agent to take actions in the environment:

- **Web Navigation Tools**: APIs or bots to browse and interact with websites (e.g., adding books to the cart, placing orders).
- **Recommendation Engines**: Suggest books based on user preferences or past behavior.
- **Purchase Mechanism**: Tools to handle checkout processes, payment options, and order confirmation.
- **Notification System**: Alerts the user with recommendations, deals, or purchase confirmations.

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4. Sensors (S)

The components used by the agent to perceive the environment:

- **Web Scrapers/APIs**: Gather data about book titles, prices, availability, shipping costs, and reviews from websites.
- **User Input Interface**: Takes user preferences (e.g., topics, budget, preferred authors, or specific keywords).
- **Payment Gateways**: Ensures secure transactions and monitors payment confirmations.
- **Feedback Mechanisms**: Collects user feedback to refine future searches.
