AI Model Question Paper - Answers

1. Pros and Cons of Cognitive Computing

Pros:

- Enhanced Decision-Making: AI analyzes large datasets for better decisions.

- Automation: Increases efficiency in complex processes.

- Natural Interaction: Uses NLP for human-like conversations.

- Personalization: Improves recommendations (Netflix, e-commerce).

- Scalability: Handles vast amounts of data beyond human capacity.

Cons:

- High Costs: Requires significant computing resources.

- Bias in Data: Can lead to unfair or biased results.

- Security Risks: Privacy concerns due to data handling.

- Complex Implementation: Needs skilled professionals.

- Interpretability Issues: AI models often work as a black box.

2. Real-World Applications of AI

- Healthcare: AI in diagnosis, robotic surgery, personalized treatment.

- Finance: Fraud detection, stock trading, risk analysis.

- Autonomous Vehicles: Tesla, Waymo for navigation.

- Chatbots & Virtual Assistants: Siri, Alexa, Google Assistant.

- Cybersecurity: AI-driven threat detection.

- Manufacturing: Predictive maintenance, smart automation.

- Education: AI-powered adaptive learning.

3. Rationality of Vacuum-Cleaner Agent

a) Simple Vacuum Cleaner Agent Function:

- If the current square is dirty -> Suck

- If in location A -> Move Right

- If in location B -> Move Left

- This is rational as it efficiently cleans the environment.

b) Rational Agent with Movement Cost:

- The agent should minimize movement and only act when necessary.

- Does not require internal state as the environment is fully observable.

c) Learning Agents for Dynamic Environment:

- Tracks cleaning history using memory.

- Learns probability of dirt appearing.

- Explores unknown areas and improves performance.

4. Definitions of AI Terms

- Agent: A system that perceives and acts.

- Agent Function: Maps percepts to actions.

- Agent Program: Implementation of agent function.

- Rationality: Maximizing expected performance.

- Autonomy: Learning from experience.

- Reflex Agent: Acts based on current percepts only.

- Model-Based Agent: Uses internal memory of the environment.

- Goal-Based Agent: Plans actions to achieve a goal.

- Utility-Based Agent: Maximizes long-term rewards.

- Learning Agent: Improves via learning techniques.

5. Is a Thermostat an AI Agent?

- Simple Reflex Agent: Yes, reacts to temperature only.

- Model-Based Reflex Agent: No, lacks memory of past states.

- Goal-Based Agent: No, does not explicitly plan.

6. Maze Navigation Problem

a) Formulation and State Space Size:

- States: (x, y, direction)

- Actions: {Turn Left, Turn Right, Move Forward}

- State space size: 4 × N × M

b) Reformulating at Corridor Intersections:

- Only store intersections as states to reduce state space.

c) Reformulating Without Orientation:

- Track only corridors and turning points, removing need for orientation.

d) Simplifications Made:

1. Ignored real-world physics (e.g., friction).

2. Discretized movement instead of continuous motion.

3. Assumed perfect sensing of walls and paths.