Final Group Project Task
Intelligent Agent Systems

Overview

Your team is tasked with designing, implementing, and analyzing a **multi-agent system (MAS)** that incorporates advanced concepts such as **optimization**, **machine learning**, and **game theory**. This project will assess your ability to apply theoretical knowledge and practical skills to solve complex problems in agent-based modeling.

Project Tasks

1. Design Your Multi-Agent System

- Define the purpose of your MAS and its primary objective.
- Provide a detailed description using the **PEAS framework**:
  - **Performance measure**: What defines success for your MAS?
  - **Environment**: Describe the environment in which the agents operate.
  - **Actuators**: Specify the actions agents can take.
  - **Sensors**: Specify how agents perceive the environment.
- Classify your agents using the AIMA framework:
  - Reflex agents, model-based agents, goal-based agents, utility-based agents, or learning agents.

2. Incorporate Advanced Concepts

Your MAS must integrate the following advanced concepts:

- **Optimization**:
  - Use optimization techniques to improve agent decision-making (e.g., solving the traveling salesperson problem, vehicle routing, or resource allocation).
- **Machine Learning**:
  - Train agents to adapt and improve using data (e.g., reinforcement learning or supervised learning for predictive tasks).
- **Game Theory**:

  - Model interactions between agents as strategic games (e.g., competitive or cooperative scenarios).
  - Include a payoff matrix or equilibrium analysis to justify your design.

3. Implement the System in MESA

- Use the `MESA` Python framework to create and simulate your MAS.
- Agents should:
  - Interact dynamically with their environment.
  - Use the concepts of optimization, machine learning, and game theory to achieve their objectives.

4. Formulate Open Questions and Run Simulations

- Define at least two open-ended questions about your MAS. For example:
  - How does collaboration improve task completion rates?
  - What strategies emerge when agents compete for limited resources?
- Run simulations to explore these questions, collect data, and analyze the results.

5. Present Your Findings

- Prepare a **15-minute presentation** summarizing your project.
- Include:
  - The purpose and design of your MAS.
  - Key implementation details, especially how you integrated optimization, machine learning, and game theory.
  - Your open questions, simulation results, and analysis.
  - Insights, challenges, and possible improvements.

Evaluation Criteria

- **Conceptual Design (25%)**: PEAS framework, agent classification, and overall design.
- **Implementation in MESA (25%)**: Functionality, code quality, and correct use of MESA.
- **Simulation and Analysis (25%)**: Quality of simulations, analysis, and insights.
- **Presentation and Communication (15%)**: Clarity, structure, and engagement during the presentation.
- **Creativity and Critical Thinking (10%)**: Originality and depth of exploration.

Submission Guidelines

- Submit:
  - `MESA` implementation code.
  - A short report (PDF) detailing your design, open questions, and simulation results.
  - Presentation slides.
- Deadline: **31st of March, 2025**.

Good Luck!

We look forward to seeing your creative and innovative multi-agent systems in action!