Assignment - 3

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Distributed Artificial Intelligence and Its Intelligent Agents

28 Nov 2024

1. Introduction

This report outlines the solutions implemented for the N Queens problem (Task 1) and the Guest-Stage utility matching problem (Task 2). The focus of both tasks was to design agent-based systems using FIPA messaging protocols, enabling agents to interact and achieve their objectives collaboratively.

2. Task 1: Queens Problem

The task involved placing N queens on an N * N chessboard such that:

- No two queens share the same row.
- No two queens share the same column.
- No two queens share the same diagonal.

Each queen acts as an independent agent and communicates with its neighbours to ensure its position adheres to the above constraints. Each queen is modelled as an agent with attributes such as its current row and whether it has found a valid position. The chessboard cells are represented as a grid, with each cell marked as occupied or free. Queens use FIPA protocols to send messages like **FindYourPosition** or **RePosition**. If a queen fails to find a valid position, it requests its predecessor to move and retry. Each queen validates its position by checking row safety and diagonal safety. If a conflict

arises, queens backtrack and adjust positions dynamically. The process terminates once all queens are positioned successfully.

The main challenge was managing dependencies between queens to avoid deadlock or infinite repositioning. This was resolved using clear messaging and retry logic, ensuring the process halts gracefully once all constraints are satisfied.

3. Task 2: Guest-Stage Utility Matching

This task involved simulating a festival scenario where guest agents choose stages to attend based on their performance and the attributes of the stages. Each guest aims to maximize their utility, calculated as the weighted sum of preferences and stage attributes. Represented stages with attributes such as lighting, sound quality and visuals. Attributes are dynamically updated every 30 simulation steps. Each guest has a separate set of preferences for stage attributes. Guests calculate utilities for each stage and choose the one with the highest utility. Guests request stage attributes via FIPA messages. Stage responds with their current attributes.

Guests reevaluate their choices periodically as stage attributes change. The highest utility determines the guests target stage. Guests and stages are displayed with distinct shapes and colours for better simulation visualization. Ensuring that guests account for dynamically changing stage attributes was a challenge. This was resolved by periodic messaging and recalculating utilities. Nested loops were optimized to ensure performance during utility computation for multiple stage and guests.

4. Challenge Solution

The primary challenge in Task-2 was ensuring guests dynamically adjust their decisions based on changing attributes while maximising global satisfaction. By integrating periodic communication and utility recalculation, the solution ensure that guests had always adapted to the latest state of the festival environment. In Task-1, the challenges of backtracking and

ensuring conflict resolution was addressed by systematically using predecessor communication and retry mechanism.

5. Conclusion

Start the tasks successfully. Demonstrated the use of agent-based modelling with FIFA messaging protocols to solve complex collaborative problems. The solution Emphasis communication, adaptability and logical decision-making, making them robust and efficient in achieving their objectives. These implementations highlight the power of agent-based systems in distributed problem-solving scenarios.