ID2209 HT23 Distributed Artificial Intelligence and Intelligent Agents

Homework 3 - Coordination and Utility
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For the first task, we need to arrange N queens on a chessboard of size NxN using the Gama environment. There are specific rules to follow, and we should come up with different arrangements depending on the value of N.
In the second task, set in a festival, there are stages where performers entertain guests. The guests move to stages based on their liking for the performances, measured by a factor called 'utility.' Guests communicate with stages through FIPA to know about individual preferences. The challenge is to create an algorithm to calculate the utilities of all participants and find ways to increase overall satisfaction by adjusting personal preferences.

Agents

Queens

For the first task, we have "Queens" as agents responsible for solving the N queens problem. They are initially placed randomly on a board and can move following specific rules. The goal is to strategically position them on an NxN chessboard through iterative moves.

Guests

As for the second task, "Guests" are the agents carried over from previous assignments. In this scenario, they have preferences for the type of performances they would like to watch. Various parameters define these preferences, and if the utility values align with those of the stage, guests start moving towards that particular stage. Their decisions are influenced by a utility function.

Stages

Lastly, we have "Stages," which are essentially the areas where guests gather to watch performances based on their preferences and an overall utility function.

Each stage calculates its utility for a particular performance, and the stage with the highest utility becomes the preferred choice for the agents.

Implementation

Task 1

In the implementation of Task 1, addressing the N Queens Problem, the queens are initially placed randomly on the chessboard. They follow specific rules, ensuring that no two queens share the same row, column, or diagonal line. Each queen then searches for a suitable position on the grid, making iterative moves until it finds its final location. The process involves calling the successor to identify and execute each move. If a queen encounters difficulty in finding a position, it can backtrack to a previous queen to explore alternative solutions. Communication among the queens is facilitated through FIPA. Ultimately, this iterative process continues until all queens are successfully positioned on the NxN chessboard.

```
Queen1
Options: [{0.0,2.0,0.0},{2.0,2.0,0.0},{3.0,3.0,0.0},{5
Moved to: 2, 6
Grid: [[1,1,0,1,1,3,1,1,0,0,1,1],[2,2,1,1,1000,2,3,2,1
Queen2
Options: [{0.0,0.0,0.0},{9.0,0.0,0.0},{0.0,2.0,0.0},{9
Moved to: 9, 2
Grid: [[0,1,0,2,2,3,2,0,1,0,2,1],[1,2,1,2,1000,3,3,3,1
Queen5
Options: [{0.0,0.0,0.0},{0.0,7.0,0.0},{10.0,8.0,0.0},+
Moved to: 0, 0
Grid: [[0,1,1,2,2,3,2,0,1,0,2,2],[1,2,2,2,1000,3,3,3,1
Queen6
Options: [{10.0,8.0,0.0},{10.0,9.0,0.0}]
Moved to: 10, 9
Grid: [[1000,2,2,3,3,4,3,1,2,1,3,3],[2,3,2,2,1000,3,3,
Queen8
Options: [{3.0,4.0,0.0},{5.0,4.0,0.0},{1.0,8.0,0.0},{1
Moved to: 10, 11
Grid: [[1000,2,2,3,2,2,3,1,2,2,3,2],[1,2,1,1,1,2,1,2,6
Queen10
Options: [{5.0,4.0,0.0},{1.0,8.0,0.0}]
Moved to: 1, 8
Grid: [[1000,3,2,3,2,2,3,1,2,2,3,3],[1,2,2,1,1,2,1,2,6
Queen11
Options: [{3.0,4.0,0.0}]
Moved to: 3, 4
Grid: [[1000,2,2,2,2,3,3,2,3,3,3,3],[3,3,2,2,1,3,3,3,1
I cannot move from: 10, 11
I am at : 10, 11 Trying to move to: 3, 4
New Location is follows: 4, 5
Queen11
Options: [{1.0,4.0,0.0},{5.0,8.0,0.0},{3.0,10.0,0.0},+
Moved to: 3, 10
Grid: [[1000,3,2,2,2,3,2,1,2,3,2,3],[2,2,2,1,0,2,2,1,1
Queen3
Options: [{1.0,4.0,0.0}]
Moved to: 1, 4
Grid: [[1000,3,2,2,2,3,2,2,2,3,3,3],[2,2,2,1,0,2,2,1,1
I cannot move from: 4, 10
I am at : 4, 10 Trying to move to: 4, 5
New Location is follows: 4, 7
I cannot move from: 1, 8
I am at : 1, 8 Trying to move to: 1, 4
New Location is follows: 1, 6
Queen3
Options: [{2.0,4.0,0.0},{6.0,8.0,0.0},{5.0,11.0,0.0}]
Moved to: 5, 11
Grid: [[1000,3,2,2,1,3,2,3,1,3,3,2],[3,3,3,2,1,2,1000,
Queen9
Options: [{2.0,4.0,0.0},{6.0,8.0,0.0}]
Moved to: 6, 8
Grid: [[1000,3,2,2,1,3,3,3,1,3,3,3],[3,3,3,2,1,2,1000,
Queen10
Options: [{1.0,4.0,0.0}]
Moved to: 1, 4
Grid: [[1000,3,3,2,2,2,3,2,3,3,3,3],[2,2,2,2,0,2,1,2,3
I cannot move from: 6, 11
I am at : 6, 11 Trying to move to: 5, 11
New Location is follows: 7, 11
I cannot move from: 7, 11
I am at : 7, 11 Trying to move to: 5, 11
New Location is follows: 6, 11
I cannot move from: 6, 11
I am at : 6, 11 Trying to move to: 5, 11
New Location is follows: 7, 11
I cannot move from: 7, 11
I am at : 7, 11 Trying to move to: 2, 6
New Location is follows: 3, 7
```
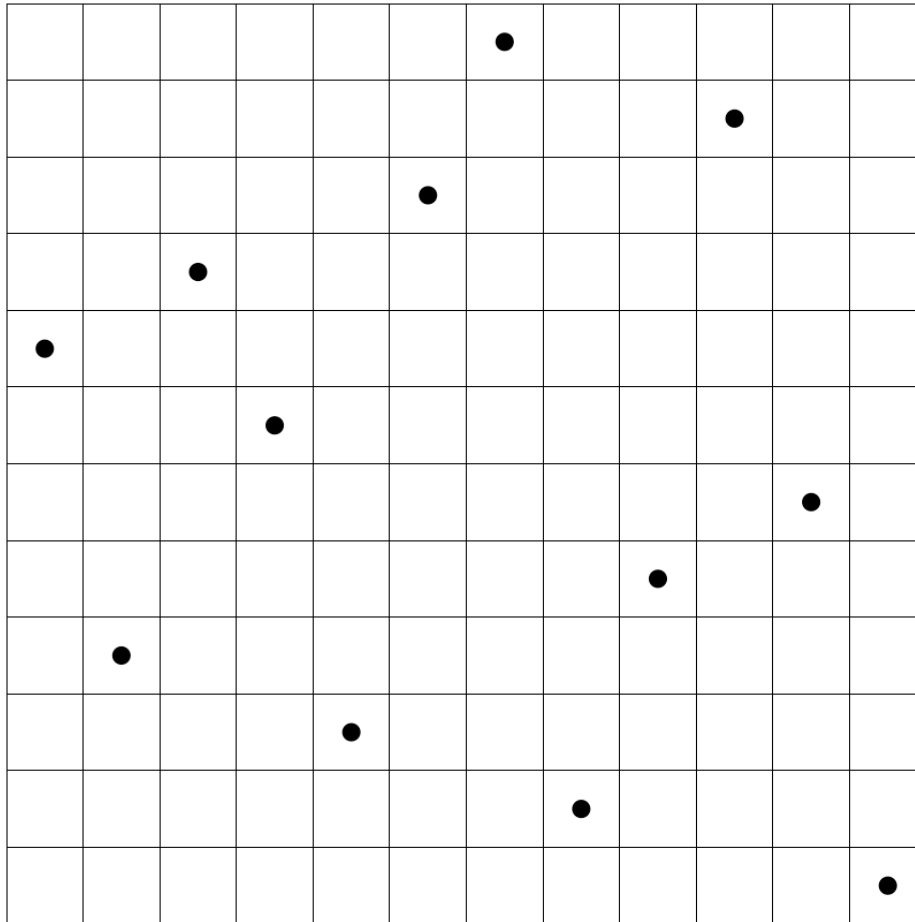
Task 2

In Task 2, the stages are equipped with six utilities: Lighting, Rock, EDM, Hip-Hop, Pop, and Acoustics. The utility of each stage is determined through a calculation involving preferences for each type, expressed as follows: utility = (preference of Lighting) * (Lighting) + (preference of Rock) * (Rock) + (preference of EDM) * (EDM) + (preference of Acoustics) * (Acoustics) + (preference of Hip-Hop) * (Hip-Hop) + (preference of Pop) * (Pop). FIPA is utilized for communication between guests and stages.

Guests, based on their preferences, move to the stage with the highest utility. Additionally, taking into account the crowd density in specific stage areas, if one stage has too many guests and there are individuals who prefer less crowded spaces, a new utility calculation is performed to accommodate this aspect. The goal remains to optimize guest satisfaction by considering both individual preferences and crowd dynamics.
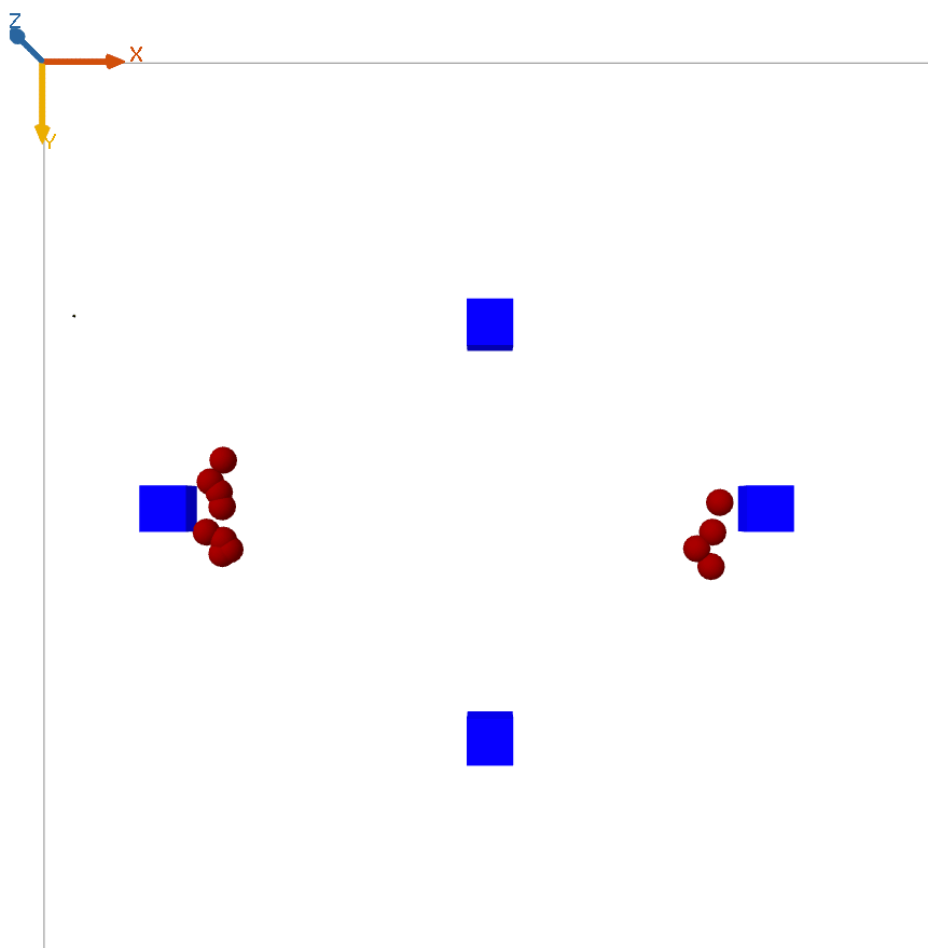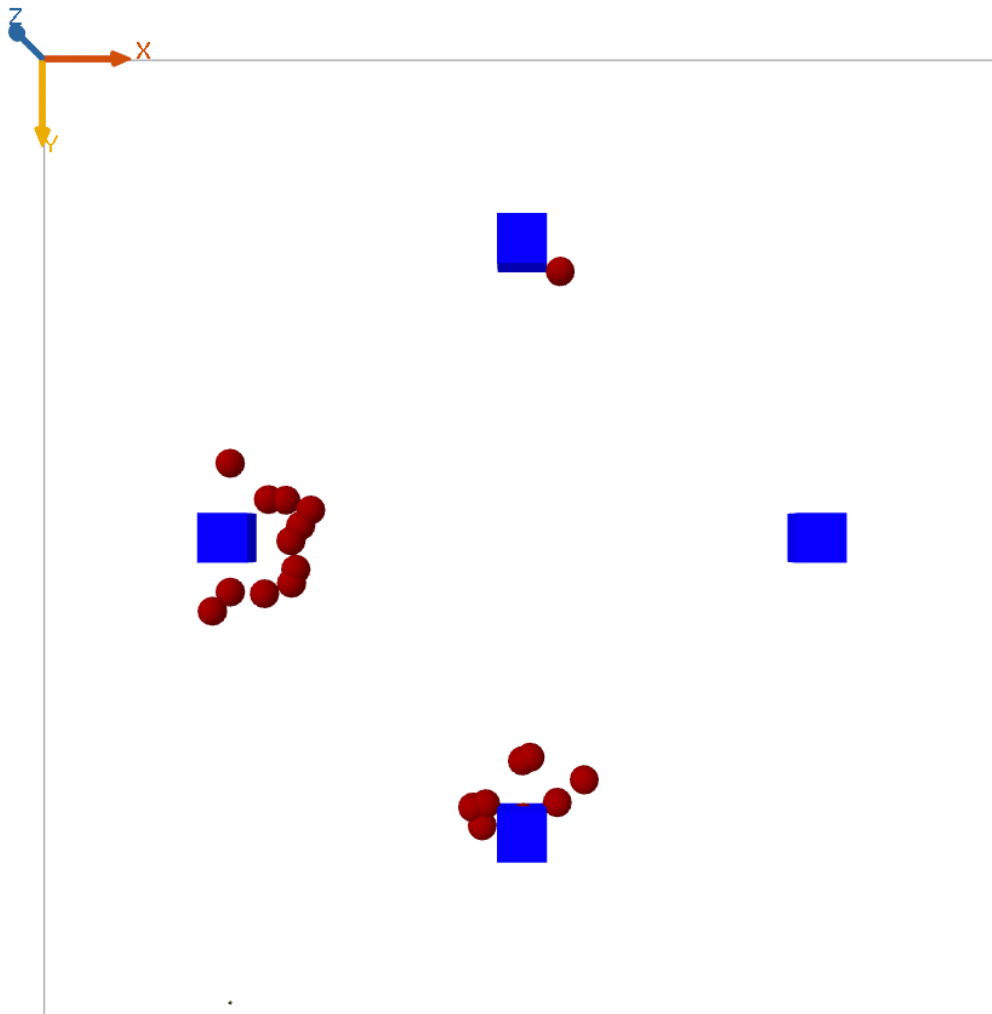
```
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest0 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest1 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest2 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest3 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest4 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest5 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest6 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest7 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest8 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest9 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest10 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest11 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,2,2,2,2,2,2,2,2,2,2,2,0]
Guest12 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest0 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest1 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest2 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest3 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest4 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest5 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,3,2,3,3,2,3,2,3,3,2,3,3]
Guest6 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
```

Challenge

In the challenge phase, agents are required to communicate with each other to understand the choices other agents are making in selecting their acts. Following the guidance in the assignment document, a leader species is employed for this communication, sharing the optimal solution and guiding the group on where to go.
This collaborative approach prompts agents to work together to maximize their overall utility. Sometimes, agents may need to make decisions that involve sacrificing their individual utility for the greater benefit of the entire group. The

focus is on achieving a collective optimization of net utility, emphasizing the importance of cooperation and shared decision-making among the agents.

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the utility is not more than the other. target to the goal from the last solution!
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest0 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest1 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest2 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest3 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest4 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest5 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest6 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest7 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest8 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest9 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest10 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest11 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest12 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest13 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest14 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest15 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest16 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest17 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[0,2,0,0,1,2,2,0,2,0,2,0,2,2,0,2,0,0,0,0]
Guest18 will move to Stage0 based on the utility calculation.
```

Conclusion

In conclusion, this assignment provides a practical opportunity to witness the collaboration of agents, showcasing their ability to work collectively and even prioritize a shared objective over individual preferences. The application of the agent utility function played a crucial role in guiding agent behavior, and the incorporation of additional parameters in the FIPA communication protocol enriched our understanding of these interactions. Overall, the assignment offered valuable hands-on experience in exploring the dynamics of agent cooperation and the influence of utility functions in achieving common goals.