ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Assignment 3
Coordination and Utility

Group 17

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The first task in this assignment is a solution to the N queens problem using the gama environment , what we try to do here is essentially create a NxN size chessboard consisting of N queens on it. The rules have been provided and we must provide multiple arrangements based on the value of N.

For the second task similar to assignments 1 and 2 this assignment is based in the festival setting with the addition of stages where the performers play and guests travel to stages based on their affinity to the act that is playing. This is computed using a variable called utility.Guests communicate with the stages present through FIPA to know the individual attribute values. For the challenge we are required to develop an algorithm to calculate the utilities of all agents and find a way to increase the global utility as a whole by making some adjustments in their personal preferences.

Agents

Queens

Used for implementation of the first task i.e solving the N queens problem. They are placed randomly on the board and can move only based on the desired rules.The aim is to finally place them in an NxN chessboard iteratively.

Guests

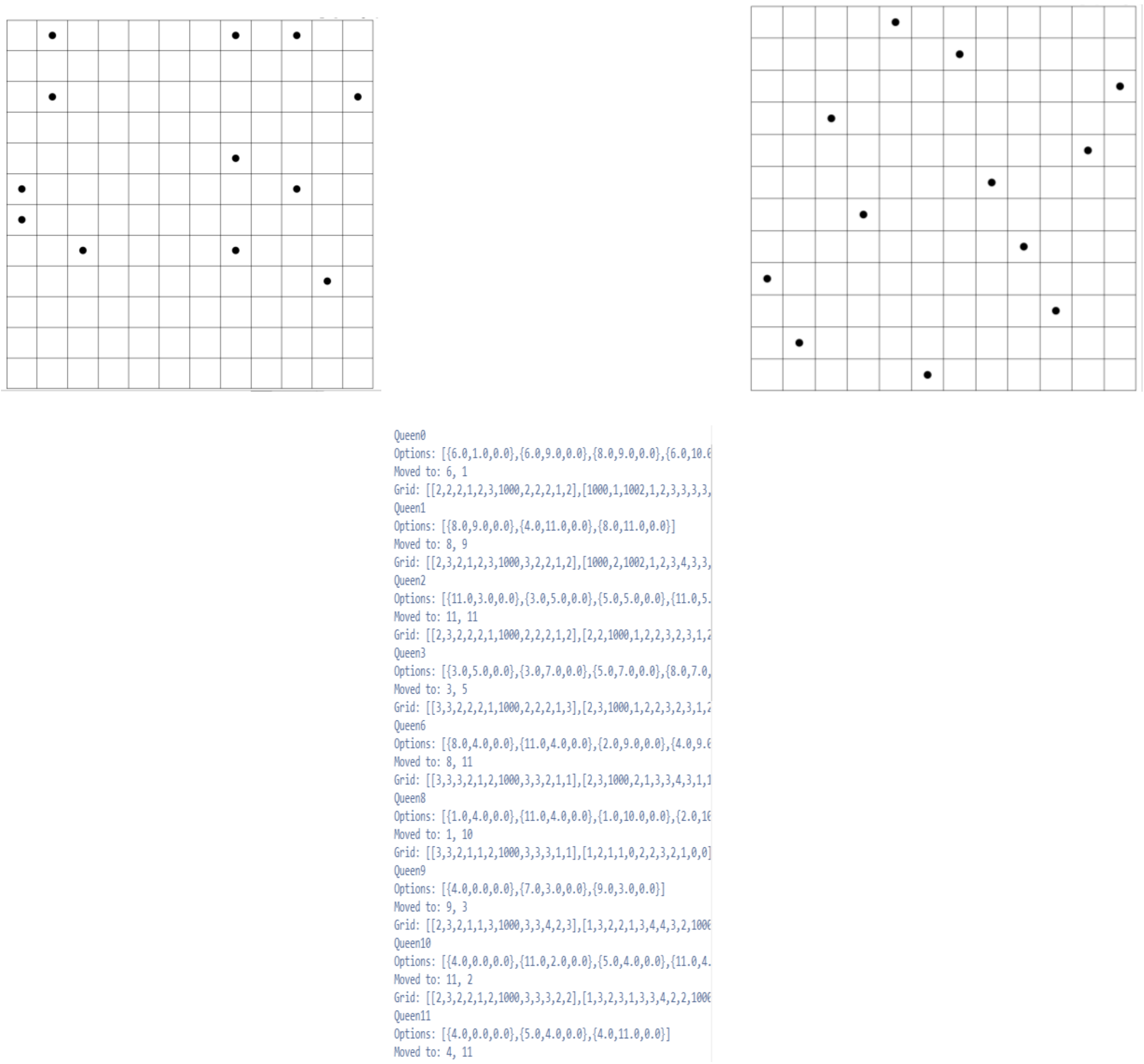
The guest agents from previous assignments are still continued. In this assignment they now have preferences for the kind of act that they would like to view. We define a bunch of parameters for the same and if the utility values of these parameters are in accordance with the utility values for the stage then the guests start moving towards that stage. Their decisions are based on the utility function.

Stages

In essence these are the regions which the guests flock to in order to see the acts that they like based on their preferences and the overall utility function. Each agent calculates its utility for a particular stage and the stage with the highest utility is picked.

Implementation: Task 1- N Queens Problem

The queens are randomly set on the chessboard and move on the basis of the rules described (No two Queens share the same row, column and diagonal line). Each queen finds a position on the grid which it moves to .Then a call is made to the successor to find and move and this carries on till the last queen finds its position. If in between no position is found then it can go back to a former queen to find a possible solution and so on. FIPA is used to communicate among the queens and finally all queens are placed in the NxN chessboard formation iteratively:



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Queen0
Options: [{6.0,1.0,0.0},{6.0,9.0,0.0},{8.0,9.0,0.0},{6.0,10.
Moved to: 6, 1
Grid: [[2,2,2,1,2,3,1000,2,2,2,1,2],[1000,1,1002,1,2,3,3,3,3,
Queen1
Options: [{8.0,9.0,0.0},{4.0,11.0,0.0},{8.0,11.0,0.0}]
Moved to: 8, 9
Grid: [[2,3,2,1,2,3,1000,3,2,2,1,2],[1000,2,1002,1,2,3,4,3,3,
Queen2
Options: [{11.0,3.0,0.0},{3.0,5.0,0.0},{5.0,5.0,0.0},{11.0,5.
Moved to: 11, 11
Grid: [[2,3,2,2,2,1,1000,2,2,2,1,2],[2,2,1000,1,2,2,3,2,3,1,2
Queen3
Options: [{3.0,5.0,0.0},{3.0,7.0,0.0},{5.0,7.0,0.0},{8.0,7.0,
Moved to: 3, 5
Grid: [[3,3,2,2,2,1,1000,2,2,2,1,3],[2,3,1000,1,2,2,3,2,3,1,2
Queen6
Options: [{8.0,4.0,0.0},{11.0,4.0,0.0},{2.0,9.0,0.0},{4.0,9.
Moved to: 8, 11
Grid: [[3,3,3,2,1,2,1000,3,3,2,1,1],[2,3,1000,2,1,3,3,4,3,1,1
Queen8
Options: [{1.0,4.0,0.0},{11.0,4.0,0.0},{1.0,10.0,0.0},{2.0,1
Moved to: 1, 10
Grid: [[3,3,2,1,1,2,1000,3,3,3,1,1],[1,2,1,1,0,2,2,3,2,1,0,0]
Queen9
Options: [{4.0,0.0,0.0},{7.0,3.0,0.0},{9.0,3.0,0.0}]
Moved to: 9, 3
Grid: [[2,3,2,1,1,3,1000,3,3,4,2,3],[1,3,2,2,1,3,4,4,3,2,100
Queen10
Options: [{4.0,0.0,0.0},{11.0,2.0,0.0},{5.0,4.0,0.0},{11.0,4.
Moved to: 11, 2
Grid: [[2,3,2,2,1,2,1000,3,3,3,2,2],[1,3,2,3,1,3,3,4,2,2,100
Queen11
Options: [{4.0,0.0,0.0},{5.0,4.0,0.0},{4.0,11.0,0.0}]
Moved to: 4, 11
```

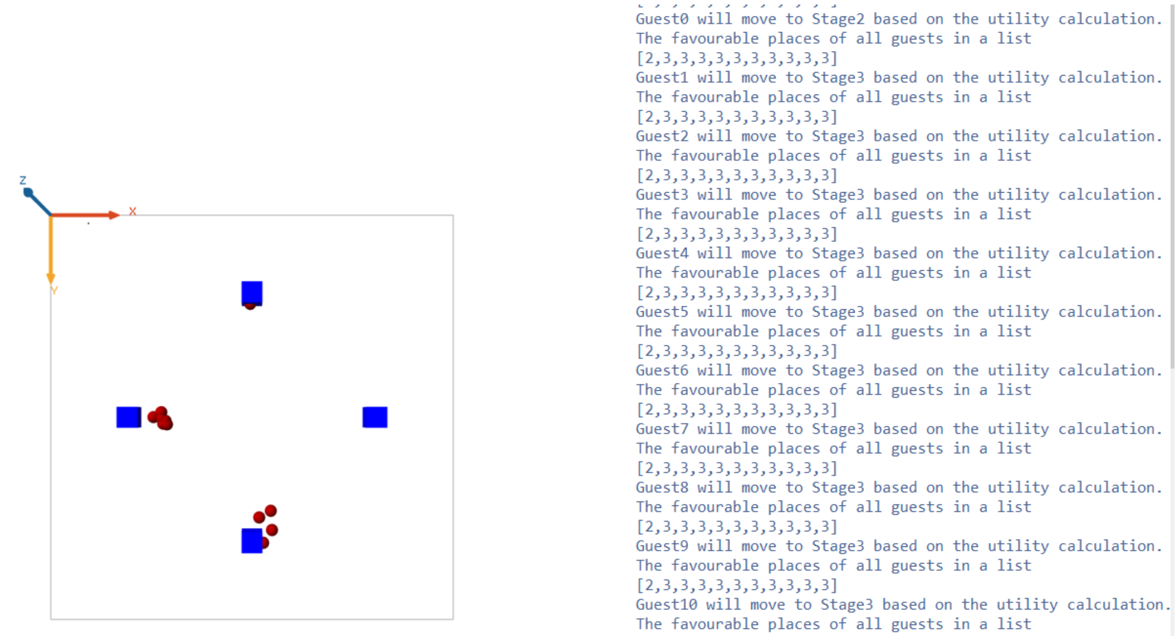
Figure 1: N-Queen problem algorithm snapshots for N=12 Queens. Snapshots of pre and post algorithm implementation and Logs.

Task 2- Highest Utility Stage

Stages are set with 6 utilities(Lighting ,Rock ,Edm ,HipHop ,Pop ,Acoustics)

Utility of each stage is computed as follows, utility = (preference of Lighting)*(Lighting) + (preferenceofRock)*(Rock)+(preferenceofEdm)*(Edm)+(preferenceofAcoustics)*(Acoustics) +(preference of HipHop)*(HipHop) + (preference of Pop)*(Pop)

FIPA is used to communicate between the guest and the stage. Guest will move to the stage with largest utility according to their preference. In addition to this specific to the crowd, if there are too many guests in one of the stage areas and there are guests who prefer less crowded areas, then a new utility is calculated accordingly.



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Guest0 will move to Stage2 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest1 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest2 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest3 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest4 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest5 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest6 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest7 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest8 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest9 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
[2,3,3,3,3,3,3,3,3,3,3]
Guest10 will move to Stage3 based on the utility calculation.
The favourable places of all guests in a list
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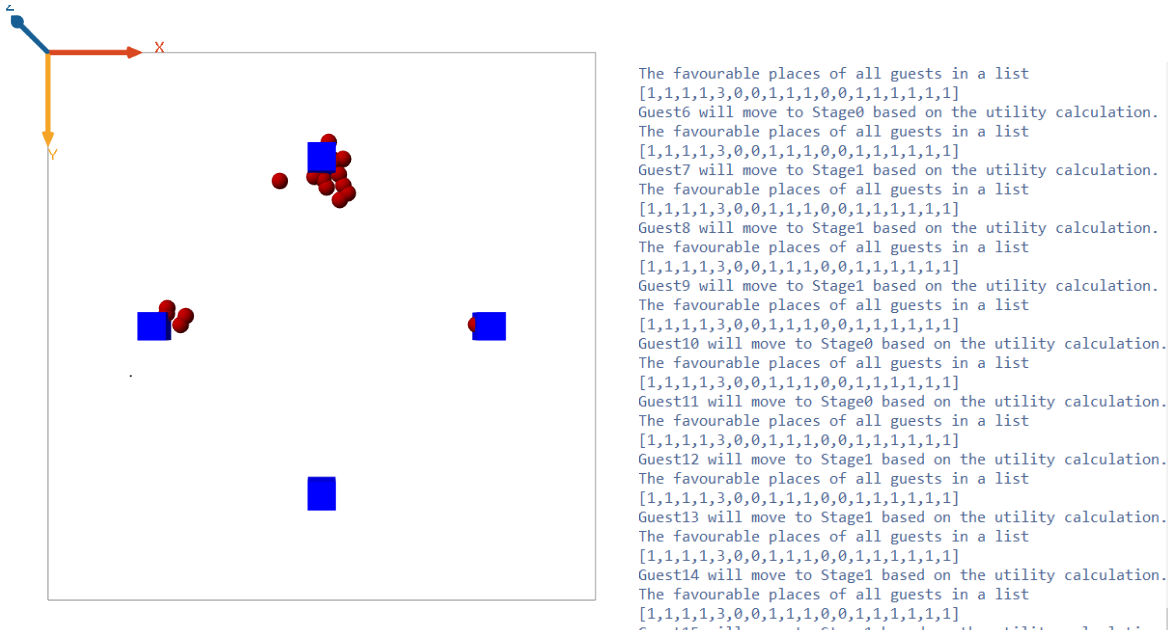
Figure 2: Fipa algorithm implementation for agents deciding preferences based on utility.

Challenge -Global Utility

Agents must communicate to know where other agents are going on picking their acts. As suggested in the assignment doc we have used a leader species for the same that communicates the optimal solution on where to go for the group. Every selection causes the agents to work together in order to maximise their utility. In some cases they will need to sacrifice their own utility to maximise the net utility of all agents.



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The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest6 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest7 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest8 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest9 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest10 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest11 will move to Stage0 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest12 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest13 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
Guest14 will move to Stage1 based on the utility calculation.
The favourable places of all guests in a list
[1,1,1,1,3,0,0,1,1,1,0,0,1,1,1,1,1,1]
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Figure 3: Implementation of the global utility where guests sacrifice their own at times to maximise total utility.

Creative Idea-The Encore

There are many times at a concert when the audience enjoys the show so much that they demand an encore. So finally once all the concerts are done each band comes out to play an encore on one final stage. This stage appears post the finishing of all other performances and is one stage which all guests flock to for one final show.

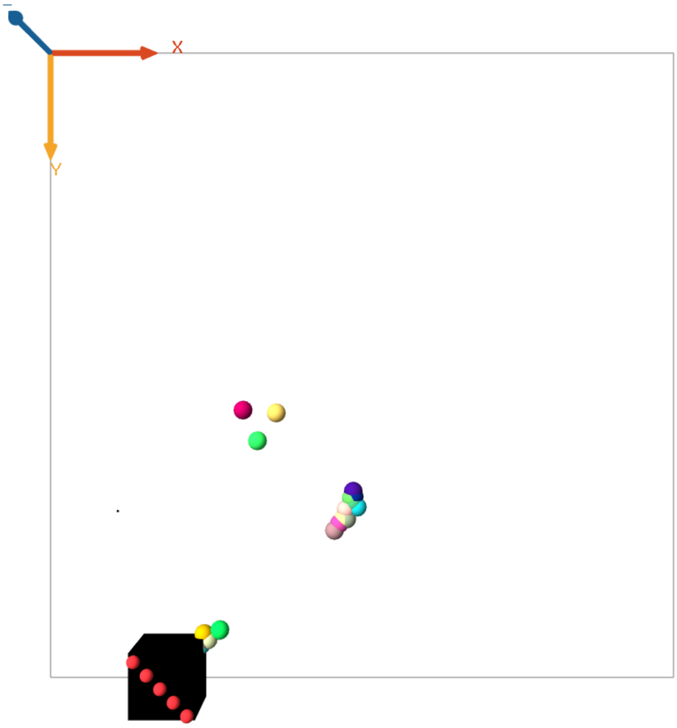

Figure 4: Guests of all different utilities gathering together for the encore gig.

Conclusions

The assignment helps us to obtain hands on experience in seeing how agents can work together and even sacrifice their preferences for achieving a common goal. We got to use the agent utility function to enforce agent behaviour and we also got to have additional parameters in the FIPA communication protocol.