Performance of Agent FTW in TAC Competition

AGENT SYSTEMS (DV2541)

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I. INTRODUCTION

Trading Agent Competition (TAC) is game consisting of 8 travel agents and each travel agent acting behalf of 8 clients. An agent is a computer system that is capable of independent action on behalf of its user or owner [1].These 8 agents compete with each other in order to provide best client satisfaction. The main goal of this travel agent is to escalate its client's satisfaction by giving them the best possible service. The winner in this game is decided by the strategy used by the agents that aims to achieve this goal. The agent with best strategy that gives the best utilities to its clients by maximising their satisfaction wins the game. The environment in which these agents work is a classic holiday travel package. Each agent provides three types of services namely, Flights tickets, Hotel rooms, and Entertainment tickets. This competition is carried out by bidding 28 simultaneous auctions for these services. The trip for each client is a 5 day package which includes all the three services.

Flight services include a round-trip flight for each client that travels from TACtown to Tampa. Firstly, the agent needs to buy tickets for the TAC air airlines. TACAir is the only flight that operates between TACtown and Tampa, and there is only one flight per day in one direction. As the package is a 4 nights and 5 days package, there is no out-flight on the first day and no in-flight on the last day. The agent buys the ticket by bidding and auctioning and then sells the tickets to the clients. The second type of service the agents provides is the hotel rooms for its clients to stay in Tampa. The client resides at least for one night in Tampa. There are two variants of hotels in Tampa; Tampa towers (TT) and Shoreline Shanties (SS).Tampa towers is more luxurious, comfortable, and tidy compared to shoreline shanties. For this reason TT costs more than SS. Once the agent allots the client a hotel room, client is not allowed to shift between TT and SS. The third and last type of service the agent provides is the entertainment tickets. Entertainment tickets are available for 3 types of events namely, Alligator wrestling, Amusement park, and Museum. There are total 8 tickets available for each type of entertainment on each day. The agent buys the event tickets from the owner and sells to their clients. Here, the agent can act both as a buyer and a seller. The client cannot use entertainment ticket on the day of departure.

The winner in this game depends on the strategies used by the agents as the better the strategy is, the more are the chances of winning. We have used our strategy for obtaining the best results having game more client utility and minimal loss. The ultimate goal is to maximize the client satisfaction by proving the desired service.

II. STRATEGIES

Initially we divided the total amount into three parts for three events namely; Flights tickets, Hotel rooms, and Entertainment tickets. We decided to allot some money to each of them and observe the results that were obtained. Dividing the amount equally was not a good option because DummyAgent had scores, which even went to negatives sometimes (that was contemplated when we had

to check if we have a working agent). So, with an intension to get positive results, we divided the amount. Assuming that hotel rooms cost more, we allotted 530 for hotel rooms, 370 for flight tickets and 100 for entertainment.

Flight

Initially, we decided not to spend more than 300 for flight tickets.. But after observing our scores in the first game played with dummy agents on tac1 server, we understood that the biddings for the flight tickets have been increasing with respect to the increase in the number of games. We decided that we could increase our budget of investment in flights and decrease it in entertainment as the entertainment was not as costly as we expected. We extended our budget of flights to 400 as the prices were rising for the third game. The agent was able to retrieve a positive score when the limit has been increased, but there were still negative scores at times. Finally, we decided not to spend more than 370 on flight tickets assuming that we will not get negative scores.

Hotel

Tampa Towers is a cleaner place when compared to Shoreline Shanties. Despite being costlier, an agent who bought a room in TT for their clients would be given bonus points. So, we considered an instance, if our agent books a room at TT for 50 and gets a bonus of 40, then we would actually be spending only 10 on the room as we would get back 40 out of 50 spent in the form of bonus; but if we buy a room Shoreline Shanties even if it costs 40, then we would be at a loss of 30 when compared to buying a room at TT. Thus, we have decided buy rooms at Tampa Towers for 50 and give the customer a benefit of comfortable living as well as a profit of 40 to the agent for every 50 spent for TT. Further, we thought the bonus points obtained for providing Tampa Towers for customers can be invested in entertainment if the customer is satisfied.
But, there were cases where the prices of TT went high. Then one question arises, what if the prices exceeded our budget and the agent could not get enough rooms for his client. This led us to the conclusion of having a sub section in our investment i.e. if the bidding exceeds a certain limit, then the agent would buy rooms at Shoreline Shanties. The limit we assumed was three-fourth of the total hotel budget; i.e. out of 530 which is allotted for Hotels, we would have 460 for TT and the remaining 70 for SS.

Entertainment

The remaining 100 of thousand is allotted for entertainment. Entertainment tickets never exceeded 60 throughout the games six games that our agent participated. So, it seemed fair for us that allotting 100 would be sufficient for Entertainment tickets. The strategy on which our agent works is: Buy all the tickets available when they are in the budget and sell them when there is a hike in the price as Entertainment follows a continuous two-way auction. The agent would then make money by selling those tickets and buy tickets according to the client preference. The happy points given by the customer and the money made by the agent by selling the tickets in auction are spent in buying the other required tickets for the client.

III. RESULT AND ANALYSIS

The games played by agent FTW are 7, 8 and 9 and the results obtained are presented as follows:

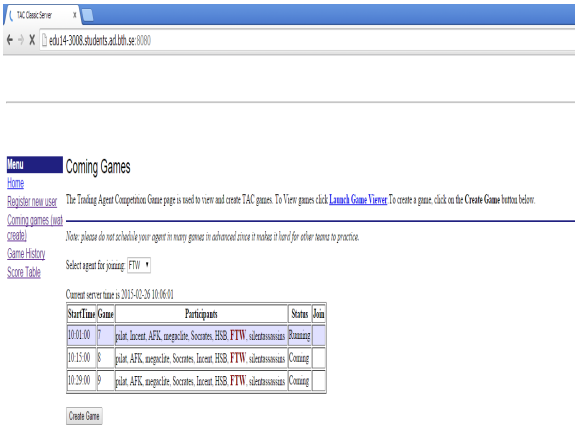

Figure 1: Depicting the games played by agent FTW

Results of Game 7

In this game, agent's utility is less than the cost, which is a negative score. According to the strategy we applied, flight tickets bought are more than the rooms that we could buy; which was the main reason for loss of money. When there were no rooms for the clients to reside, the flight ticket proved to be useless. If the investment in flight could be reduced and hotels could be increased, then the scores would have been positive.

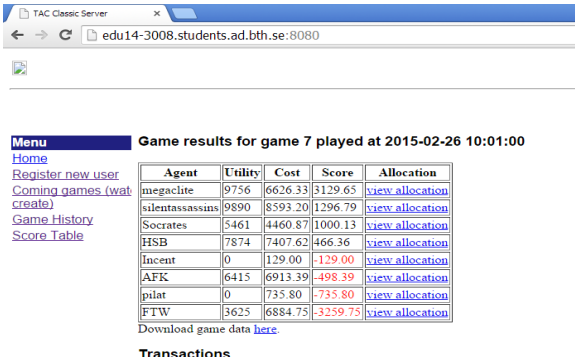

Figure 2: Scores in Game 7

Results of Game 8

In this game, the utility of the agent is less than the cost; which is a positive score.. The prices of the flight tickets were similar to the first game (i.e., game 7), but there was a change in the auction of Hotel rooms. The rooms were bided lower than the last time, which was in favour to the agent FTW, as it was within the budget allotted.

The agent received better profits in entertainment as some tickets were also sold, which is an improvement when compared to game 7.

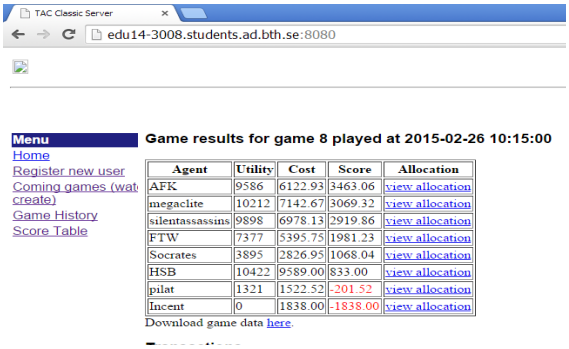

Fig 3: Scores in Game 8

Results of Game 9

Game 9 was played better than Game 7.The bidding of Flight tickets was considerably low, hence affecting the performance of the agent. The tickets bought were more than the Hotel rooms rented which resulted in loss to the agent. Entertainment tickets were bought and sold better than the first game, but the profit in entertainment could not overcome the loss in Flight ticket proceedings.

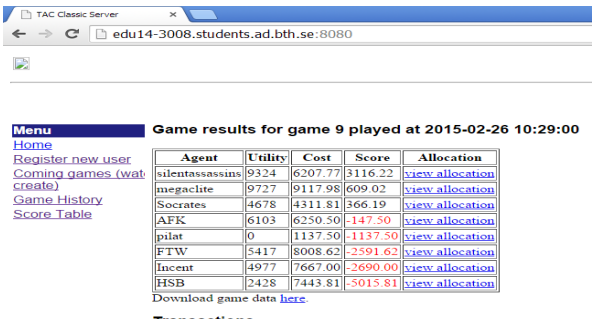

Fig 4: Scores in game 9

Analysis

After observing the results of the games played by us, we analysed that the strategy we applied was not appropriate for dynamically changing ticket prices. So, for getting more appropriate results, we can fetch dynamically changing budget values (using arrays) according to varying bids in auction by making few changes in the code. Also if the agent could connect to the server and retrieve the values, the biddings would be profitable.

IV. CONCLUSION

By participating in this Trading Agent Competition, an overall idea about auctions and bidding has been grasped. We learnt about auctions and their proceedings in real time scenario. We were able to learn the knack of competitive spirit by participating in the game. This assignment helped us know where we can enhance our strategy in order to win. We got an idea about the method of programming in gaming environment. Few changes in programming could be done to implement our strategy in a better way An input can be taken from the server to make a note of the current highest bid and then bid more than that for the next time. This strategy would increase the agent's chances of winning the auction, which in turn will result in winning the game. Considering the limited time constraint, we could not understand the strategy used in DummyAgent, as the number of games we played is less. This affected our overall performance, as we had to work over the strategy first and then make changes to the existing code accordingly. Playing TAC helped us understand the concept of Agent Systems in a practical way when compared to subjective learning from a prescribed textbook.

References

[1] M. Wooldridge, *An Introduction to MultiAgent Systems*. John Wiley & Sons, 2009.

APPENDIX - Implementation of the Strategy

JAVA programming was used to create a working agent. Using the strategy stated above for Flights, Hotels and Entertainment, the dummy agent code was changed as follows:

```
private void sendBids()
{
   for (int i = 0, n = agent.getAuctionNo(); i < n; i++)
{
    int alloc = agent.getAllocation(i) - agent.getOwn(i);
    float price = -1f;
    switch (agent.getAuctionCategory(i)) {
    case TACAgent.CAT_FLIGHT:
          if (alloc > 0) {
            price = 370;
          }
          break;
    case TACAgent.CAT_HOTEL:
          if (alloc > 0) {
            price =530 ;
            prices[i] = 50f;
          }
          break;
    case TACAgent.CAT_ENTERTAINMENT:
          if (alloc < 0) {
            price = 100;
            prices[i] = 100f;
          } else if (alloc > 0) {
            price = 50;
            prices[i] = 50f;
          }
          break;
    default:
          break;
    }
```

The Hotel Strategy

The agent has been designed to bid and buy the rooms in hotel Tampa Towers if the cost of the room is below 530. When the bidding for rooms in the auction exceeds 530, then the agent bids rooms in Shoreline Shanties.

```
// if the hotel value is less than 530 we will select the
    // expensive hotel (type = 1)
    if (hotel <530) {
          type = TACAgent.TYPE_GOOD_HOTEL;
    } else {
          type = TACAgent.TYPE_CHEAP_HOTEL;
    }// the budget has already been decided as 530
```