Exercise 5: An Auctioning Agent for the Pickup and Delivery Problem

Group 39: Hugo Bonnome, Pedro Amorim

November 24, 2016

1 Bidding strategy

1.1 General outline

We use these general assumptions to build our strategy:

- The costliest actions are when vehicles travel with empty trunks. Having parcels to deliver while going to a specific destination offsets the cost of travel.
- There are no time constraints to deliver tasks. As such there is no penalty in accepting a large number of tasks and delaying their deliveries and pickup times.
- Since there are only two agents playing the competition can be assimilated to a zero sum game; i.e. only the relative difference with the profit from the adversary counts, not the absolute value.
- There is a lower bound on the number of tasks that is equal to 10.

With these assumptions in mind we constructed our strategy as follows. Since there is going to be at least 10 tasks into play, a task that might seem disadvantageous at the beginning might become profitable if it is followed by other deliveries and pickups. As such it is advantageous to fill the trunks of the cars at the beginning. To ensure this our bidding strategy starts very aggressively, with the possibility of bidding lower than our own current marginal cost with the hope that this loss will be minimized when the number of accepted tasks reaches a certain threshold.This also has the effect of preventing the adversary agent from winning tasks early and ensures that we will keep a head start in the profit differences.

1.2 Implementation details

Bids are computed by following a simple rule, we want to maximize the average difference between our gain and the opponent gain. To this end we have the following procedure:

1. We estimate the parameters of the adversary by assuming it has the same cumulative capacity as ours.
2. With the help of the estimated parameters of the adversary we can now estimate its marginal cost.
3. We keep the history of bids from the adversary and the difference between our predictions and the actual results. We can call it prediction error.
4. We assume that each prediction error is independent and comes from the same distribution.
5. With this information in hand we can compute the expected value of the adversary's marginal cost by using the distribution of the prediction error.

6. Now if our marginal cost is lower than the adversary's we simply add an offset to our own marginal cost and bid this value. If not we try to estimate if taking this task at a loss now would be compensated in the future and bid appropriately.

2 Results

2.1 Experiment 1: Comparisons with dummy agents

2.1.1 Setting

2.1.2 Observations

⋮

2.2 Experiment n

2.2.1 Setting

2.2.2 Observations