Excercise 3
Implementing a deliberative Agent

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1 Model Description

1.1 Intermediate States

One state is represented by:

- `currentCity` the current city of the vehicle
- `remainingTasks` the remaining tasks to pickup
- `currentTasks` the tasks currently carried by the vehicle

1.2 Goal State

The goal state are the states for which `remainingTasks` and `currentTasks` are empty

1.3 Actions

Actions are either going to pickup a remaining task if its weight is less than the available space in the trunk, or delivering a current task.

2 Implementation

2.1 BFS

We implement BFS using a linked list. We decided to keep track of nodes of the tree which have the end up in the same state (`currentCity`, `remainingTasks`and `currentTasks`) but with different costs and keep only the one with the lowest cost.

2.2 A*

We implement `A*` using a priority queue, first with the heuristic function $h(x) = 0$, then with two other heuristic functions detailed bellow.

2.3 Heuristic Function

- h is the minimum of the distance of several randomly picked path, multiplied by a discount. This one is not guaranteed to be admissible and optimal.
- h is the maximum over all remaining packages of the distance to pickup and deliver this package. this heuristic is admissible and optimal.

3 Results

3.1 Experiment 1: BFS and A* Comparison

3.1.1 Setting

We use the topology `config/topology/switzerland.xml`. And the second heuristic for ASTAR.

3.1.2 Observations

Our implementation of ASTAR can compute an optimal solution in less than one minute for 7 tasks, but BFS can do it only for 6 tasks. They both give optimal results.

3.2 Experiment 2: Multi-agent Experiments

3.2.1 Setting

We ran two ASTAR agents on the topology `config/topology/switzerland.xml`.

3.2.2 Observations

We observe that the agents have several conflicts and even though they achieve the whole delivery in less time, they do not have an optimal collaboration.