CS-430 : Problem Definition for the Reactive Agent Assignment

Titouan Renard, Christophe Marciot

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1 Problem definition

We are trying to implement an agent that functions according to the following basic procedure.

Algorithm 1: Basic Agent Logic

```
while goal not reached do
    if current plan not applicable anymore then
        Compute optimal plan
    end
    else
        Execute next action in the plan
    end
end
```

In this case optimality is defined as *minimum cost function*. And the cost function is computed for any road taken as such :

$$c(\text{road}) = l_{road} \cdot c_{kil}$$

Where the value l_{road} is the length of a given road and the value c_{kil} is the cost per kilometer for a given agent.

Computing an optimal plan can be though of as finding a plan p_{opt} such that:

$$p_{opt} = argmin_p\{cost(p) \mid \text{ p reaches a goal}\}$$

Where to cost of a plan is simply given by :

$$cost(p) = \sum_{r \in \text{ roads in the plan}} cost(r)$$

The *goal* of our agent is to deliver all tasks on the map, all of these tasks as well as the length of every road and the cost per kilometer are known prior to planning.

Our agent has the ability to perform multiple tasks at the same time but has a maximum weight that it can carry, it has to verify :

$$\sum \text{ carried tasks } \leq \text{ agent capacity}$$

We will use *BFS* and *ASTAR* to find an optimal solution.

2 States, Transitions and Goals

Since we are working in a deliberative agent paradigm, we will not generate every possible state prior to planning, instead we will define states as a set of variables that are defined by our algorithm as it searches the solution space.

2.1 Transitions

Our agent can perform two basic actions

1. It can drive from one city to another
2. It can decide to pickup or not to pickup a task when it is in a given city

We therefore construct our state representation around those two fundamental transitions :

1. **drive(start, destination)** : the movement action between two *adjacent* cities.
   Cost function defined as : $cost_{drive}(road_{start,destination}) = l_{road} \cdot c_{kil}$
2. **pickup(task)** : the action of adding a contract to be carried by the agent
   Cost function defined as : $cost_{pickup} = 0$