Exercise 2: A Reactive Agent for the Pickup and Delivery Problem

Group 39: Hugo Bonnome, Pedro Amorim

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1 Problem Representation

1.1 Representation Description

The topology T is graph defined by $T = \{C, P\}$ where C is the set of cities in the topology and P the set of paths connecting these cities.

1.1.1 State representation

The state s of a given agent is defined by $s = \{c, t_d, N_c\}$ where $c \in C$ is the city where the agent currently is, $t_d \in C \cup \{None\}$ indicates whether there is a task to city d in c (being equal to $None$ when no task is available) and $N_c \subseteq C$ is the set of cities that can be reached from c, in other words the neighbours of c.

1.1.2 Actions

The agent can:

- Move towards a neighbour n, this will be denoted $M(n)$
- Pickup a task in the current city and deliver it to the destination city, this will be denoted $D(t_d)$. We assume that the agent never attempts the pickup action if there is no task available in its current city.

1.1.3 Reward

For the action of moving to a neighbour:

$$R(\{c, t_d, N_c\}, M(n)) = -dist(c, n)$$

where $n \in N_c$ and $dist(c, n)$ is the shortest path distance between c and n. This value can be justified by the fact every km that we travel without a profit implies a loss.

For the action of picking up a task and delivering it:

$$R(\{c, t_d, N_c\}, D(t_d)) = AR(c, d)\frac{1}{dist(c, d)}$$

with $AR(c, d)$ being the average reward from delivering a task from city c to city d which is ponderated by the distance between both cities.

1.1.4 Probability transition table

The uncertainty in the world state only comes from the presence of a task in a given city or not. It does not depend on the type of action taken by the agent.

$$p(\{c, t, N_c\}, (M(n)|P(n)), \{n, t_d, N_n\}) = P(n, d)$$
$$p(\{c, t, N_c\}, (M(n)|P(n)), \{n, None, N_n\}) = probNoTask(n)$$

where $P(n, d)$ is the probability of there being a task in city n whose destination is d and $probNoTask(n)$ is the probability of city n having no task which can be computed by $1 - \Sigma_{c \in C} P(n, c)$.

1.2 Implementation Details

2 Results

2.1 Experiment 1: Discount factor

2.1.1 Setting

2.1.2 Observations

2.2 Experiment 2: Comparisons with dummy agents

2.2.1 Setting

2.2.2 Observations

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2.3 Experiment n

2.3.1 Setting

2.3.2 Observations