

Excercise 4

Implementing a centralized agent

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November 5, 2018

1 Solution Representation

1.1 Variables

Instead of representing a vehicle's journey as a sequence of tasks, we chose to represent it as a sequence of *pickup* and *delivery* actions. Each task $t \in \mathcal{T}$ has one action of both types.

$$\mathcal{P} = \{pickup(t) : t \in \mathcal{T}\}, \mathcal{D} = \{delivery(t) : t \in \mathcal{T}\}, \mathcal{A} = \mathcal{P} \cup \mathcal{D}$$

This accounts for the fact that a vehicle can carry multiple tasks at a time if there are two pickups in a row. The following variables define the first pickup of each vehicle (where \mathcal{V} is the set vehicles).

$$\forall v \in \mathcal{V} : firstPickup(v) \in \mathcal{P} \cup \{\mathbf{null}\}$$

If the variable is **null** this means the vehicle does not accomplish any actions. All subsequent actions of a vehicle are defined by the next set of variables:

$$\forall a \in \mathcal{A} : nextAction(a) \in \mathcal{A} \cup \{\mathbf{null}\}$$

where again the **null** signifies that a vehicle has no further actions to perform. We will define two other sets of variables which will clarify the former:

$$\forall a \in \mathcal{A} : vehicle(a) \in \mathcal{V}; \quad \forall a \in \mathcal{A} : time(a) \in \{0, 1, 2, \dots\}$$

The *vehicle* variables define which vehicle carries out a certain action. This can be derived from the *firstPickup* action at the start of each action chain defined by *nextAction*. (For example if $firstPickup(v) = a, nextAction(a) = b$ then $vehicle(a) = vehicle(b) = v$.)

The second variable can also be derived from the action chains. It simply gives the rank of each action in the chain (for example if $firstPickup(v) = a, nextAction(a) = b$ then $time(a) = 1, time(b) = 2$).

1.2 Constraints

1.3 Objective function

2 Stochastic optimization

2.1 Initial solution

2.2 Generating neighbours

2.3 Stochastic optimization algorithm

3 Results

3.1 Experiment 1: Model parameters

3.1.1 Setting

3.1.2 Observations

3.2 Experiment 2: Different configurations

3.2.1 Setting

3.2.2 Observations