



Crowdsourcing VRP

General Setting

Given a graph $G=(V, A)$. Denote with $O \subseteq V$ the subset of deliveries offered for crowdsourcing and with $A \subseteq O$ the set of accepted offers, which is only revealed at the end of the day

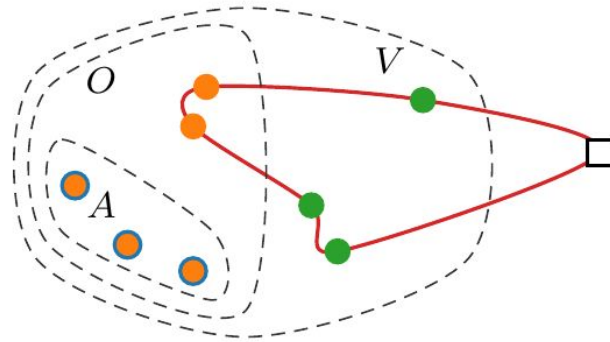
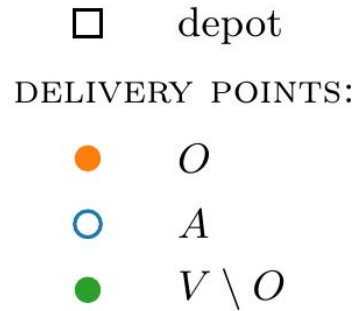


Figure 1: Relation between sets V , O and A . The figure also shows the TSP tour of the owned vehicle when A is the set of deliveries accepted for crowdsourcing.

General Model

The optimization model is:

$$\mathbb{E}_A[C(O)] = \sum_{A \subseteq O} \left[\underbrace{\left(\prod_{i \in A} p_i \prod_{i \in O \setminus A} (1 - p_i) \right)}_{\text{Prob. that } A \text{ is the accepted set}} \cdot \underbrace{\left(\sum_{i \in A} m_i + c_{V \setminus A} \right)}_{C(O,A) = \text{cost when } A \text{ is the accepted set}} \right]$$

The objective of the problem is to find the set O^{opt} which gives the lowest expected cost:

$$O^{\text{opt}} = \arg \min_{O \subseteq V} \mathbb{E}_A[C(O)]$$