Vehicle Routing Problem (VRP)

A seller needs to send trucks with goods to customers.
Let be the following constraints:
- Demand of each customer must be satisfied by one truck;
- Truck capacity must not be exceeded for any truck;
- Total distance should be minimized (*Objective function*);

Parameters
- n = amount of points (1 - depot, 2, ... , n - customers)
- d_{ij} = distance from node i to node j
- D_i = demand of customer i
- C = capacity of each truck

Variables

$$- x_{ij} = \begin{cases} 1 & \text{if a truck goes from node } i \text{ to node } j; \\ 0 & \text{otherwise.} \end{cases}$$

- f_{ij} = number of units in a truck going from node i to node j.

$$min \sum_{i=1}^{n} \sum_{j=1}^{n} d_{ij} \cdot x_{ij} \tag{1}$$

s.v

$$\sum_{j=1}^{n} x_{ij} = 1 \qquad \forall i = 2, \cdots, n \tag{2}$$

$$\sum_{j=1}^{n} x_{ji} = 1 \qquad \forall i = 2, \cdots, n \tag{3}$$

$$\sum_{j=1}^{n} f_{ji} - \sum_{j=1}^{n} f_{ij} = D_i \qquad \forall i = 2, \cdots, n \tag{4}$$

$$0 \leq f_{ij} \leq C \cdot x_{ij} \qquad \forall i, j = 1, \cdots, n \tag{5}$$

$$x_{ij} \in \{0, 1\} \qquad \forall i, j = 1, \cdots, n \tag{6}$$