VRP for a package delivery service

Oláh Sarolta

ELTE, Budapest

May 31, 2023

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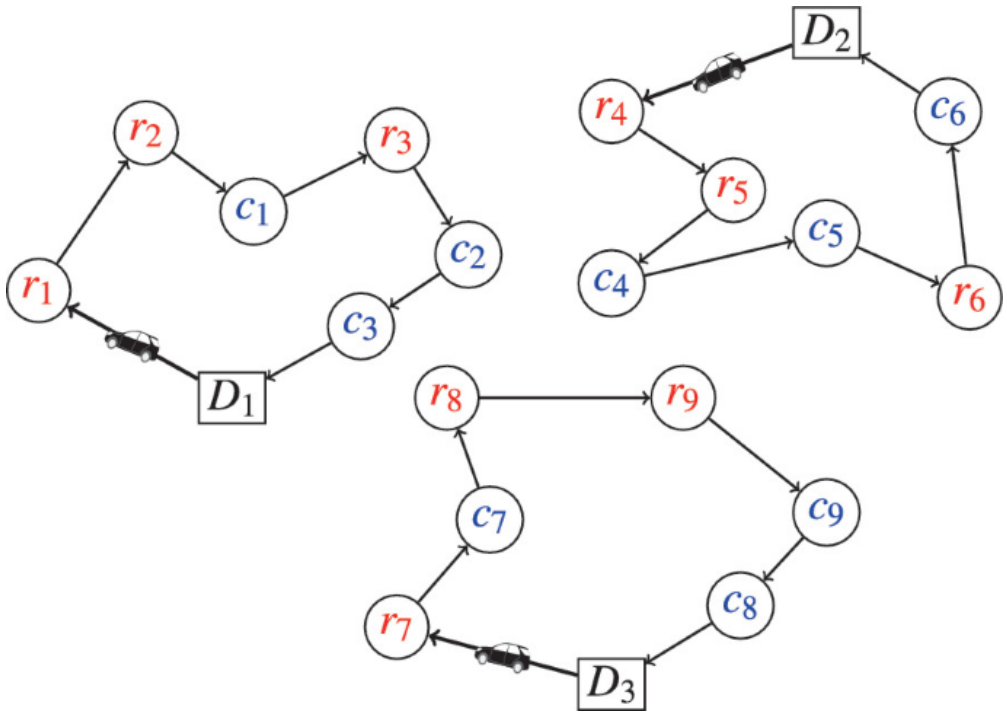
The problem

- Deliver packages. The vehicles are in several depots.
- It is represented on a graph.
- The goal is to minimize the travel cost, or to maximize the number of delivered packages.



The model

$$\min \sum_{i,j,k} c_{ij} x_{ijk} \tag{1}$$

$$t_j - t_i \geq 1 - M(x_{ijk}) \qquad \forall\ k \in K, (i,j) \in A \tag{2}$$

$$\sum_j x_{\sigma_l jk} - \sum_i x_{i\tau_l k} = 0 \qquad \forall\ k \in K, (\sigma_l, \tau_l) \text{ pair} \tag{3}$$

$$t_{\sigma_l} \leq t_{\tau_l} \qquad \forall (\sigma_l, \tau_l) \text{ pair} \tag{4}$$

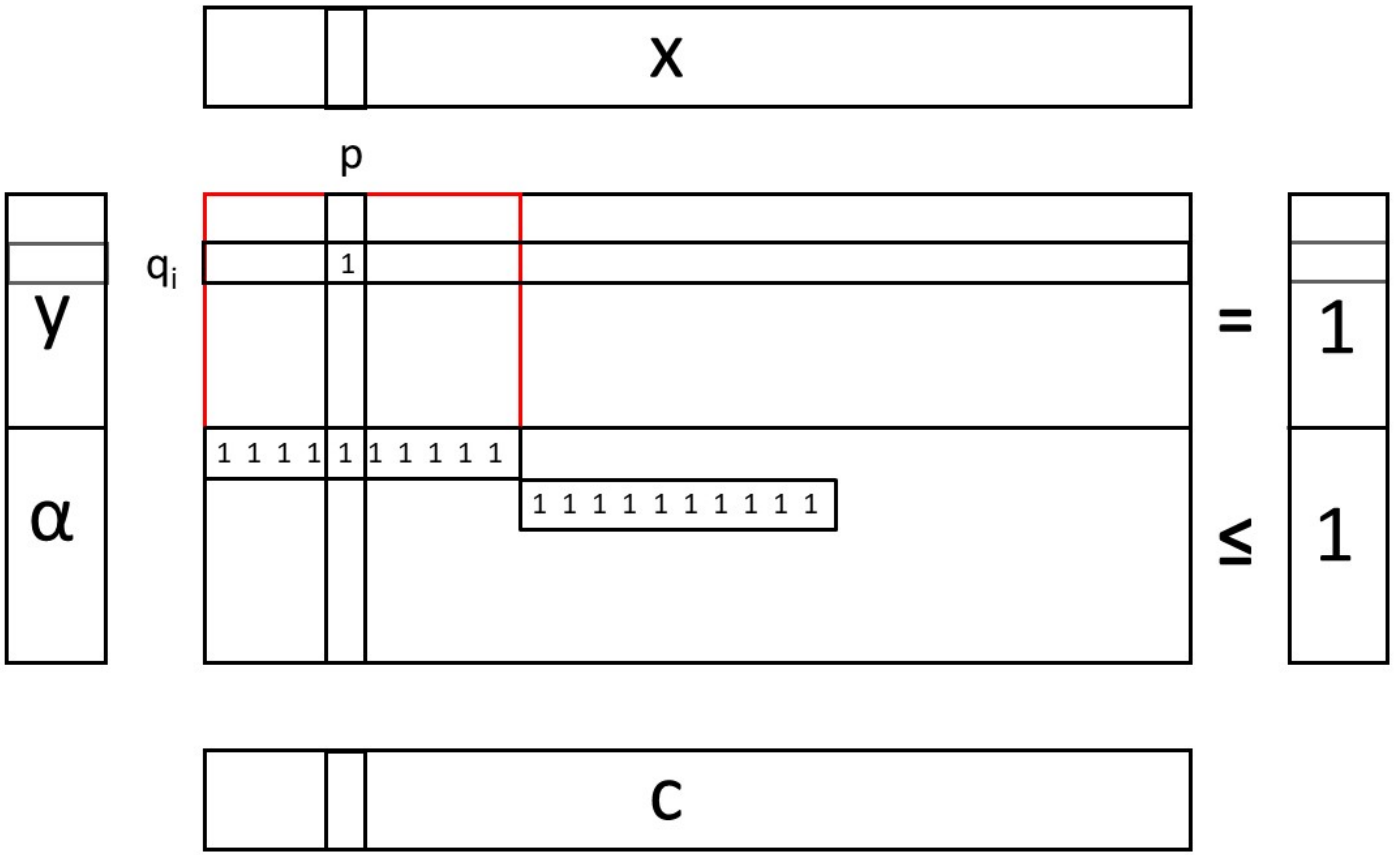
$$\sum_{j,k} x_{ijk} = 1 \qquad \forall\ i \in V \tag{5}$$

$$x_{ijk} \in \{0,1\} \qquad \forall\ k \in K, (i,j) \in A. \tag{6}$$

Possible solutions

- IP-solver (C++, Cplex).
- Column generation.

Column generation

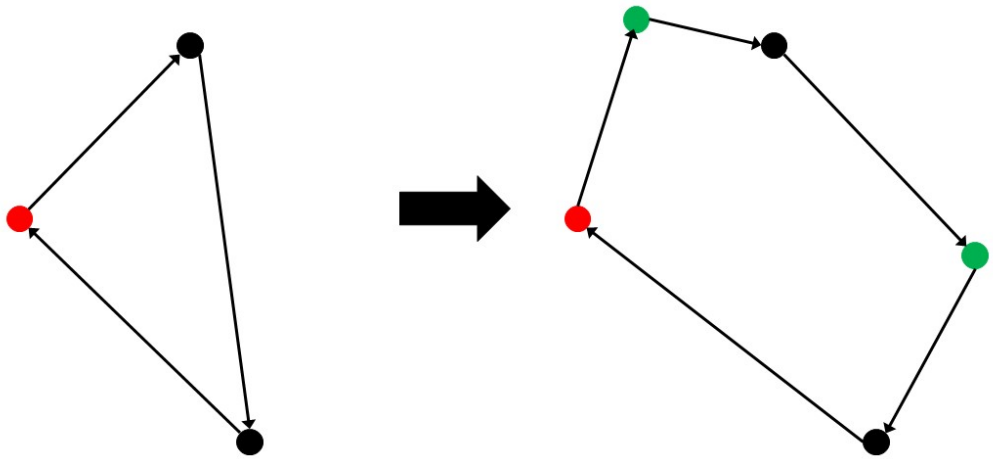


Column generation

- Dual feasibility.
- Pricing problem: $\min\{c_p - \sum y(q_i)\}$.
- Problem for one vehicle.

Column generation

- IP
- Heuristic.
  - Route with one package.
  - Insert packages.



Future plans

- Consider time-windows, vehicle capacity.
- Users availability, position.
- Accelerate the code.

Thank you for your attention!