# Optimització de rutes de vehicles (Vehicle Routing Problems)

**Referència:** Aráoz, J., Fernández, E. and Zoltan, C. Privatized Rural Postman Problems. *Computers & Operations Research*, **33(12)** (2006), pp. 3432–3449.

**Abstract:** In this work we analyze the privatized rural postman problem which is the edge version of the traveling salesman problems with profits. The problem is defined on a undirected graph $G(V, E)$ with a distinguished vertex $d$, called the Depot. There are two non-negative real functions on the edge set $E$, which define the value of a cycle in $G$: one is the profit function, $b$, and the other one is the cost function, $c$. They have different meanings when a cycle $C$ traverses an edge $e$ (possibly more than once), because we pay a cost $c_e$ every time $e$ is traversed, but we collect the profit $b_e$ only the first time $e$ is traversed. The privatized rural postman problem is to find a cycle $C^*$, passing through $d$ and not necessarily simple, which maximizes the sum of the values of the edges traversed in $C^*$. That is, $\max_C\{\sum_{e \in E}(b_e - t_e c_e)\}$ where $t_e$ is the number of times that edge $e$ is traversed in $C$. We study some properties of the problem: we show that it is NP-hard, its relation with known and new problems, and special cases with good algorithms. We also analyze several integer linear systems of inequalities, which define the polyhedral structure of the problem, and we give dominance and preprocessing conditions. We finish with some remarks and comments about future research.

---

**Referència:** Aráoz, J., Fernández, E. and Franquesa, C. The Clustered Price-collecting Arc-routing Problem. *Transportation Science*, **43(3)** (2009), pp. 287–300.

**Abstract:** Prize-collecting arc routing problems are arc routing problems where, in addition to the cost function, there is a profit function on the edges that must only be taken into account the first time that an edge is traversed. This work presents the clustered prize-collecting arc routing problem where there are clusters of arcs and it is required that all or none of the edges of a cluster be serviced. The paper studies properties and dominance conditions used for formulating the problem as a linear integer program. An exact algorithm for finding an optimal solution to the problem is also proposed. At the root node of the enumeration tree, the algorithm generates upper and lower bounds obtained from solving an iterative linear programming-based algorithm in which violated cuts are generated when possible. A simple heuristic that generates feasible solutions provides lower bounds at each iteration. The numerical results from a series of computational experiments with various types of instances illustrate the good behavior of the algorithm. Over

75% of the instances were solved at the root node, and the remaining instances were solved with a small additional computational effort.

---

**Abstract:** In this article a stochastic location-routing problem is defined and cast as a two-stage model. In a first stage the set of plants and a family of routes are determined; in a second stage a recourse action is applied to adapt these routes to the actual set of customers to visit, once they are known. A two-phase heuristic is developed. An initial feasible solution is built by solving a sequence of subproblems, and an improvement phase is then applied. A lower bound based on bounding separately different parts of the cost of any feasible solution is also developed. Computational results are reported.