



Optimization Algorithms for the Vehicle Routing Problem

Rodrigo Rosatti Galvão

School of Technology

University of Campinas (UNICAMP)

R. Paschoal Marmo, 1888 - Jd. Nova Itália CEP:13484-332 - Limeira, SP

rodrigorosattig@gmail.com

Luis A. A. Meira

School of Technology

University of Campinas (UNICAMP)

R. Paschoal Marmo, 1888 - Jd. Nova Itália CEP:13484-332 - Limeira, SP

meira@ft.unicamp.br

ABSTRACT

The Traveling Salesman Problem (TSP) is one of the most studied of combinatorial optimization. A generalization of TSP is the Vehicle Routing Problem (VRP). This problem creates k cycles that cover all delivery points (customers) with a special vertex in common (depot). The VRP has additional requirements according to the situation. In this research we studied and implemented several algorithms for the TSP and VRP such as the 2-approximation based on the minimum spanning tree (MST) algorithm, the 1.5-approximation based on the Christofides algorithm, and also a local search single-swap heuristic. As intermediate steps, we solved the MST problem using the Kruskal algorithm, and the minimum matching using a single-swap algorithm. We also implemented a java graph package with several operations and a package to visualize the solutions. The objective was to execute instances with 28 thousand vertices, but the largest instance we could execute had 6417 vertices. At end, we study heuristics and algorithms for VRP. We implemented Clarke & Wright's Savings Algorithm. This research was partially supported by FAPESP (Grant Number nº 2016/08481-6 and 2015/11937-9) .

KEYWORDS. VRP, TSP, Routing, Logistics, Transportation.

Paper topics: Routing, Heuristics for VRP, Implementation of a graph package with MST, Minimum Matching, Christophides among others.