Multiple Traveling Salesman Problem [DRAFT]

Navid Kooshkjalali

Autumn 2020

Abstract   The multiple traveling salesman problem (mTSP) is a generalization of the famous traveling salesman problem (TSP), where more than one salesman is allowed to be used in the solution. While there is a considerable body of literature sorounding the TSP and variants of it like the vehicle routing problem (VRP), mTSP which seems to have various real-life applications is not yet researched thoroughly. The purpose of this survey is to apply a genetic algorithm, a heuristic method which produces a feasable solution within reasonable time, to solve the mTSP in Scala.

1 Introduction

1.1 Blueprint

This paper will proceed as follows: TSP and mTSP will be formally introduced. Incrementally better (faster) solutions will be offered for both. Different approaches to solving each problem are discussed. Finally a genetic algorithm will be implemented in Scala for both the TSP and the mTSP.

1.2 Problem Statement

1.2.1 TSP

Given a set of nodes, let there be a salesman located at a single depot node. The remaining nodes (cities) that are to be visited are called intermediate nodes. Then the TSP is finding the tour that starts and ends at the depot, such that such that each intermediate node is visited exactly once and the total cost along that tour is minimized. This is equivalent to finding the least weight Hamiltonian cycle in a complete weighted graph. Since mTSP is an extention of TSP all mTSP solutions are also valid TSP solutions.

1.2.2 mTSP

Given a set of nodes, let there be m salesmen located at a single depot node. The remaining nodes (cities) that are to be visited are called intermediate nodes. Then, the mTSP consists of finding tours for all m salesmen, who all start and end at the depot, such that each intermediate node is visited exactly once and the total cost of visiting all nodes is minimized. This is a relaxation of the VRP, where the capacity restrictions are removed. This means that solutions for the VRP are also applicable to mTSP by giving sufficiently large capacities to the salesmen. However the scope of this paper will be limited to mTSP and solutions for the VRP will not be discussed.