University College London

Department of Computer Science

COMP3091 – Individual Project for BSc Computer Science

Project Title Solving Travelling Salesman Problems using Genetic Algorithms

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Abstract

This project investigates how Genetic Algorithms can find near – optimal solutions to the *Travelling Salesman Problem*. A Genetic Algorithm works by selecting and combining parts of cheaper solutions from the search space. The Genetic Algorithm is inspired from biological concepts of Natural Selection, Crossover, Mutation, Inheritance, etc.

This project investigates methods for crossing over solutions. These methods are the *Order (OX), Cycle (CX)* and *Partially Mapped (PMX)* Crossover. Also investigate are mutation methods known as *Single Swap (SSM)* and *Inversion (IM)*. The aim is to see which of these *Path* representation methods are better in finding near – optimal solutions.

The investigations were conducted by practical experimentation and involved the construction of a Genetic Algorithm. Experiments were carried out on *bays29*, a benchmark graph representing the geographical distances between 29 cities. Similar work was carried out on *bays29* by Albert Jan Yzelman (University of Utrecht); the near-optimal solutions obtained were similar to my project's results.

The best set of results involved both *OX* and *IM* producing on average solutions within 3.6% of *bays29's* optimum. The *OX* tries to preserve *Ordering of Nodes* instead of *Absolute Position of Nodes* and maintains the concept of *Genetic Linkage* in which *IM* tries to facilitate. It was concluded that operators preserving *Ordering of Nodes* were more effective in contributing to near – optimal solutions as empirical analysis suggest that information about potential good node combinations aren't broken up. As a result there is a tendency for good node combinations to be inherited during crossover which is analogous to the concept of *Genetic Linkage*.