A solution for the Capacitated Vehicle Routing Problem (CVRP) using the Simple Genetic Algorithm

Ana Dumitras

The Simple Genetic Algorithm was used to solve the special version of the Capacitated Vehicle Routing Problem, The FruityBun Challenge. The algorithm implemented solves the Traveling Salesman Problem for the cities given in the description and then attempts to adapt the route to the CVRP by adding depot noted on the route when the capacity of the truck is exceeded.

Initialization

We start the algorithm by generating a random sample from all the possible permutations of the natural numbers between 0 and 250.

Selection

I have used two methods of selection: Tournament Selection where I use the fittest chromosome out of 5 randomly chosen chromosomes from the sample, and Roulette Wheel Selection. For Roulette Wheel Selection I compute the fitness value for each chromosome in the sample population and based on their fitness each chromosome receives a number of cells in a roulette wheel array. The greater the fitness, the more cells it will have. Each cell of the roulette wheel array contains the position of the chromosome in the population. The roulette wheel array is shuffled and each time we need a new parent we generate a random position in the roulette wheel array and return the parent whose index in the populations is stored in the roulette wheel array. For this particular case of CVRP, Roulette Wheel Selection seems to perform better.

Crossover

I have tested three different crossover algorithms: PMX, ordered crossover [1] and a special version of the ordered crossover. The special version of the ordered crossover inserts the missing nodes from parent2 starting from the beginning of the offspring instead of starting from the end of the section copied from parent1. I am using all three algorithms for generating new chromosomes.

Mutation

I used a high mutation rate (0.25) and two different mutation techniques (Swap mutation and Insert mutation).

References

[1]http://www.theprojectspot.com/tutorial-post/applying-a-genetic-algorithm-to-the-travelling-salesman-problem/5