Capacitated Vehicle Routing Problem (CVRP) Using Tabu Search (TS)

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INTRODUCTION

Tabu search algorithm is used in this CVRP project. In this solution, tabu search solves the travelling salesman problem (TSP) which is find the best routing without considering the capacity of the trucks and the depot. Then the capacity of the truck is took into consideration. [1]

REASON FOR USING TS ALGORITHM

TS algorithm using a tabu list to record the current best solution. In the next search, it finds the neighbor candidate and compares to the solution recorded in the list in order to avoid searching previously-visited solutions (or conditionally search them). As a result, this can avoid local optimum. Compare to hill climber, it can find the better solution. Compare to other algorithm, TS needs fewer iterations.

Furthermore, tuba search algorithm is ease to understand. So this is convenient to find the solution of CVRP.

SOURCE OF THE ALGORITHM

At the beginning of the project, serval attempt have been made to solve the travelling salesman problem. The TS algorithm is found on a website. http://blog.csdn.net/wangqiuyun/article/details/8816463

After learning how to solve TSP, I add the capacity and depot and solve it as CVRP. The source of algorithm is as follow. https://www.lzane.com/mo-ni-tui-huo-vehicle-routing-problem-vrp-using-simulated-annealing-sa-with-matlab/

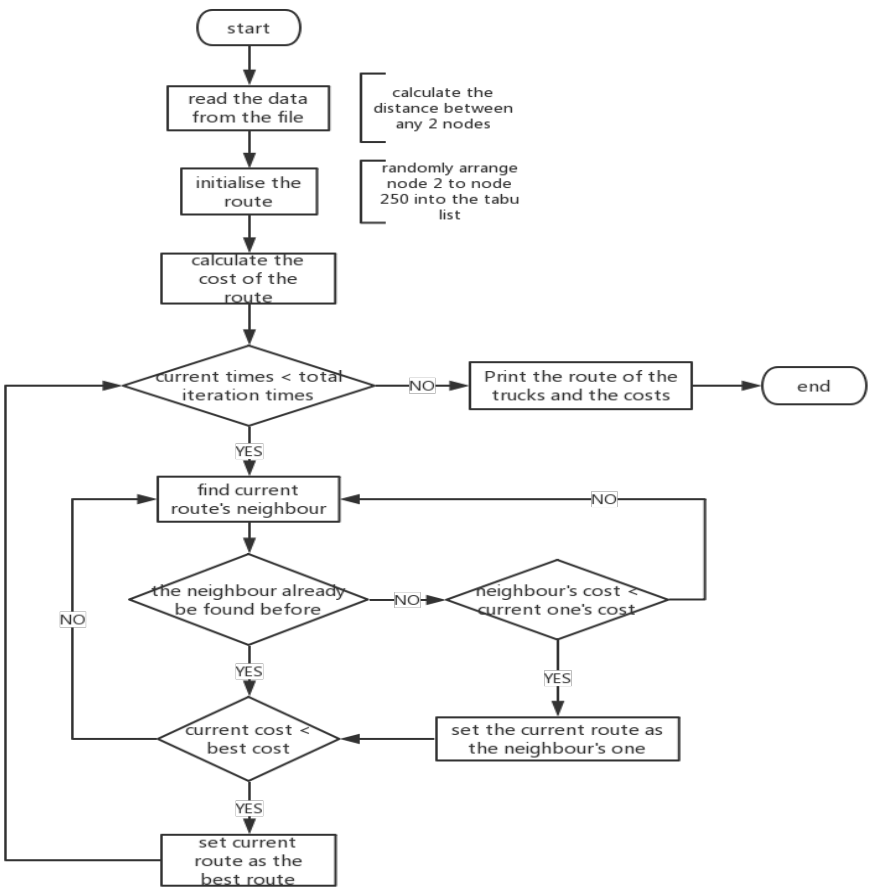
EXPLANATION OF THE SOLUTION

In this solution, some parameters are set to realize the algorithm.Integer MAX_GEN, N, l, and shopNum are used to record number of iteration, neighbor, tabu length, and nodes respectively. Array distance represents the distance between 2 shops. Array candidate, LocalCandidate, and bestCandidate are used to show the initial route, current route, and best route. And parameters are set to record their costs individually. Parameter tabu list[l][shopNum] use to record the the previous search.

The length of the tabu list is 50 in this programme.

Every time it searches 300 neighbors.

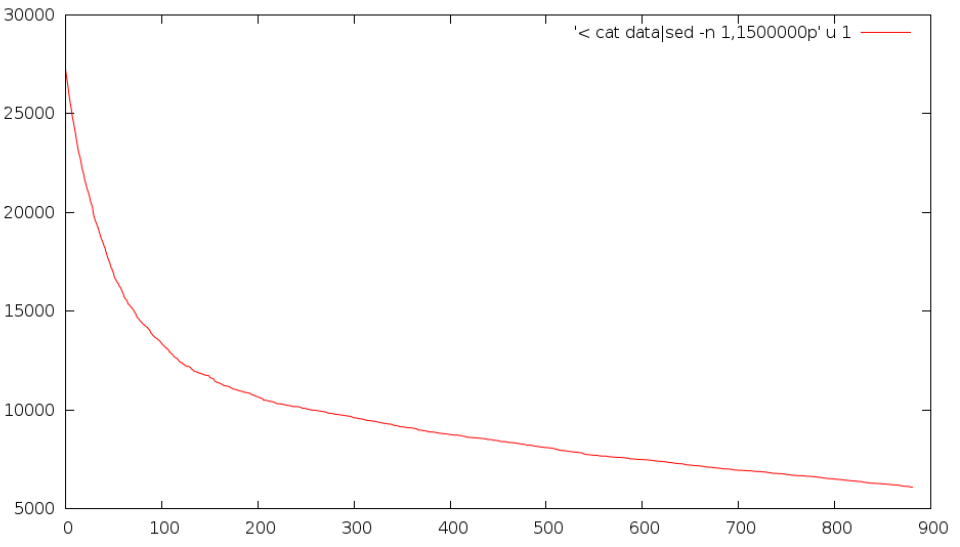
The flow chart of the programme is shown as picture 1.



Picture 1. flow chart of the programme

SOLUTION OF CVRP

In this project, the number of nodes is 249. And the capacity of each truck is 500. Picture 2 shows the costs during 1, 500, 000 times of iteration. It is obvious that at the start of the algorithm, the costs drop dramatically. Then it tends to be gentle. Finally, the cost reach 5984 which is the best-so-far cost in this solution. 25 trucks are used to in the best route. And it takes about 15 minutes to find the solution.



Picture 2. costs in total during 1, 500, 000 times of iteration

REFERENCE

[1] https://en.wikipedia.org/wiki/Tabu_search