Arc Routing Problem

一给定的连通图中，其中若干边需要某种服务，有一个车队以网络中的某个特殊点作为车场，车队中的所有车辆假定是同一车型的，由该车队中的每辆车提供相关服务。每条边均必须由一辆车提供服务，且服务需要一次完成，所有边均允许被经过任意多次，每辆车从车场出发并且在服务完成后再回到车场

邮路问题等等。

CARP

一无向连通图中，给定一组有着固定容量限制的车辆，对图中非负需求边遍历，确定一条路径，在该路径上所有需求边的需求量不能超过装载车的容量，并且每辆车从车场出发再回到车场。

应用领域有城市垃圾回收、冬季道路除雪、道路洒水、街道清扫、输电线路检测等方面。

genetic algorithm

```
Procedure GA
Begin
        T=0;
        Initialize    p(t) ; //p(t)表示 t代种群
        Evaluate    p(t);    //评估第t代种群
        While not finished do
        Begin
                T=t+1;
                Select p(t) from p(t-1); //从上代种群众选择较优秀的个体到下代子群
                Reproduce pairs in p(t);
                Evaluate p(t);
        End
End
```

1. 代码架构设计好，不同功能模块尽量隔离，高内聚，底偶合

2. 控制随机数种子，让实验结果可重复

3. 生成器部分，是着重部分，它决定了你的单次搜索空间大小（技巧比如越差的解变异概率越大、引入新的基因）

genetic algorithm

- ***cell.py***: contains three based functions.

  dijkstra(edges, from_node, to_node)

  dijkstra_raw(edges, from_node, to_node)

  Those two funtion are used to comput the smallest cost of each route.

  get_data(data_file): used to get the data by given file path.

- ***Solution.py***:contains two functions and two classes.

  route: a based data structure of solution.

  solution: a solution class which is consist of multiple routes.

  deal_routes(routes,depot=1): used to change the inital route like (1,4),(5,3),(1,1),(7,8),(9,1),(1,1) to be real route set like:route 1:(1,4),(5,3); route 2:(7,8),(9,1). It is used in next function.(depot is 1 here)

  make_random_solution(data,max_route_len=9999): used to get a inital satisfying solution.In particular, it get the inital route like (1,4),(5,3),(1,1),(7,8),(9,1),(1,1) and then use deal_routes(routes,depot=1) to get real route set so that it can be easier to generate solution.

- ***GA.py***: contains three functions and one classes. It is the main part of genetic algorithm.

  init(solution, edges, co_dict, dem_dict, CAPACITY, depot=1): used to reduce the number of solutions which contains only one edge as one of its routes. For example, there are route 1:(1,4),(5,3),(7,8); route 2:(9,1) in a solution. This function will merge them into one route (1,4),(5,3),(7,8),(9,1) if the demand of the new route is no more than capacity.(depot is 1 here)

  cross(solution, edges, co_dict, dem_dict,end_time,depot=1): used to do cross operation. The two target routes which are chosen to do cross are seleced randomly. Those target edges are chosen randomly,too.

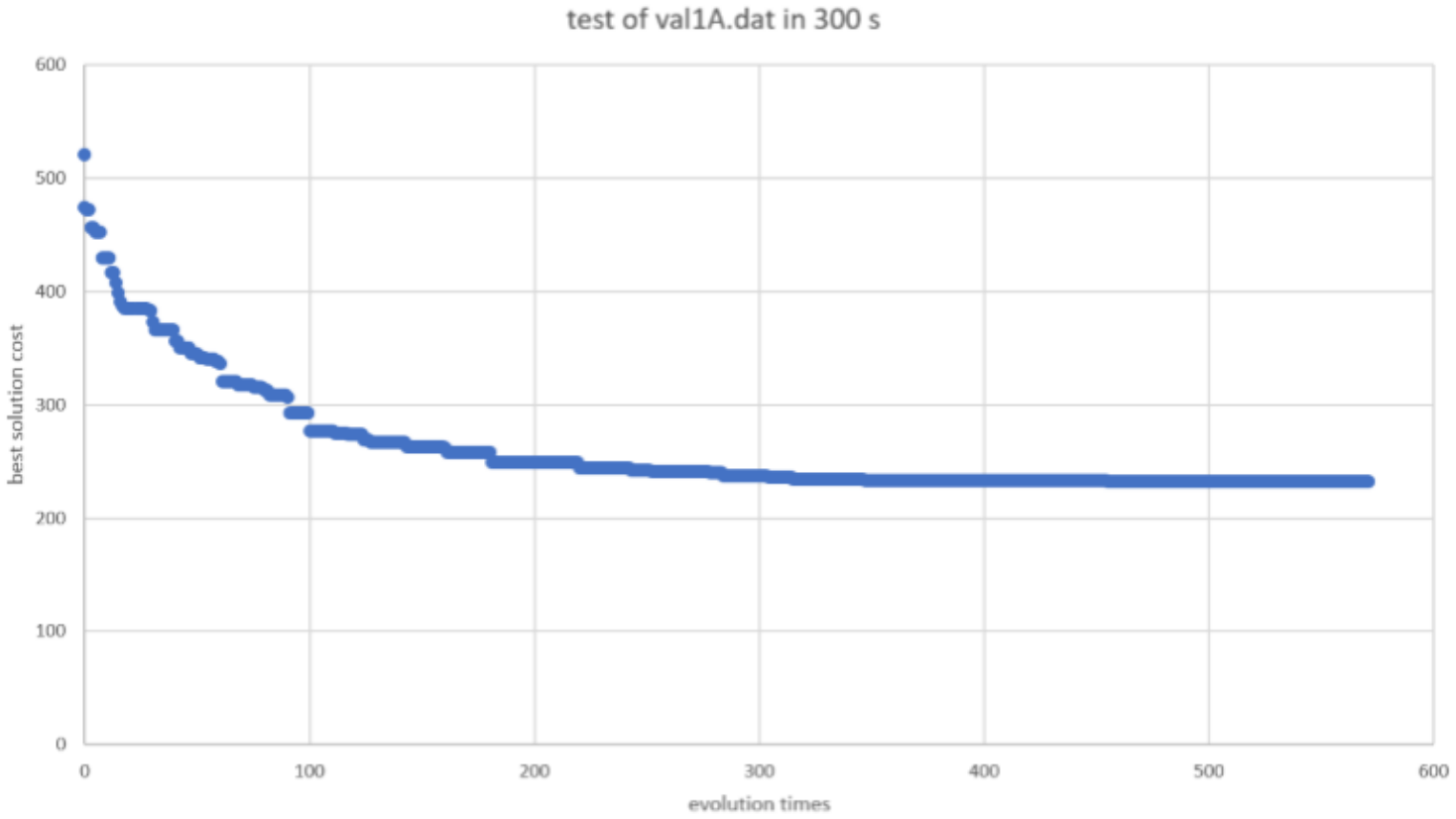
  mutate_ratation(solution,edges, co_dict, dem_dict,end_time): used to ratate the target edge in target route.

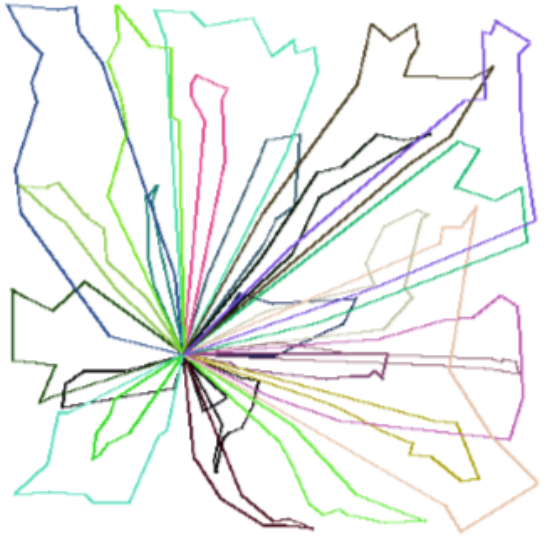
  mutate_change(solution,edges, co_dict, dem_dict,end_time): used to change position of the target edges in target route.

  Population: a data structure which is consist multiple solutions.It contains ***evolution(self,end_time,number,poss,edges, co_dict, dem_dict, depot=1)*** function which is used to do evolution easily.

- ***CVRP_solver.py***: used to get parameters and control all process in this program.

genetic algorithm





genetic algorithm

1、 遗传算法的早熟现象(即很快收敛到局部最优解而不是全局最优解)是迄今为止最难处理的关键问题。

2、 快要接近最优解时在最优解附近左右摆动，收敛较慢。

改进的遗传算法：

1、 分层遗传算法（Hierarchic Genetic Algorithm）

2、 CHC算法

3、 Messy算法

4、 自适应遗传算法（Adaption Genetic Algorithm）

5、 基于小生境技术的遗传算法（Niched Genetic Algorithm，简称NGA）

6、 并行遗传算法（Parallel Genetic Algorithm）

7、 混合遗传算法：遗传算法与最速下降法相结合；遗传算法与模拟退火法（Simulated Annealing）相结合

Thinking

数据结构： 图

变一变？变成向量？Deep Walk、Graph CNN

算法： 搜索

估算解空间大小：衡量解簇之间的相似性？