MSc in Business Analytics 2023-24

Large Scale Optimization

Competitive Assignment

Teams Declaration: https://docs.google.com/spreadsheets/d/1jpFD5yMAg_4_gVCkBu96WvFSp1BncnasJ-e1DtLXNa8/edit?usp=sharing

(2-4 team members)

Deadline: 15 Jan 2024

We deal with a logistics optimization problem which is aimed at minimizing the total energy required for transporting problems to a set of 250 geographically dispersed customers.

The characteristics of the problem are given in the following:

1. We must transport goods from a central warehouse to a set of 250 customers $N = \{1,2, \dots ,250\}$, based at various locations.
2. Each customer $i \in N$ has a predetermined product demand d_i.
3. To transport products, a homogeneous fleet of vehicles has been leased
    a. Each vehicle has a tare weight (empty vehicle weight) $T = 6\ tn$.
    b. Each vehicle has a maximum carrying capacity of goods $Q = 8\ tn$.
4. Each vehicle starts its route from the central warehouse (depot) $d = \{0\}$ and visits a customer set.
5. Each customer $i \in N$ is served once by exactly one vehicle. Thus, when a vehicle visits a customer location, it delivers the complete delivery amount d_i.
6. The routes are completed at the last served customer (leased vehicle fleet – open routes)
7. The cost of the logistics system is the total tn x km travelled by the vehicle fleet.

Thus, the definition of the routes must minimize the total gross tn x km travelled by all vehicles (empty vehicle weight plus the weight of transported goods).

To clarify the how the objective is calculated, suppose we have a one route solution S: $(0,2,3,4,1)$ for a toy problem of 4 customers. The objective of solution s is obtained as:

$$z(S) = (T + d_2 + d_3 + d_4 + d_1) * c_{02} + (T + d_3 + d_4 + d_1) * c_{23} + (T + d_4 + d_1) * c_{34} + (T + d_1) * c_{41}$$

Comments

The problem is given in the text file Instance.txt

The distance of any customer pair (in km) is obtained as the Euclidean distance between the two customers.

Deliverables

- You should submit your code (as a zipped folder).
- Your code must run within five minutes in a modern PC system

- Your code must generate a txt file with the final solution complying with the format of the file example_solution.txt. Your solution file must be included in the zipped folder that you will submit.
- You can use the provided sol_checker script to check if your solution file sdatisfies the constraints of the problem model and if your reported solution is valid.

If your code makes use of any random generators, these must be seeded with any of the following seeds: 1, 2, 3, 4, 5.

Grading

- The production of an initial feasible solution is graded with 6 points.
- The production of a feasible improved solution (by means of an improvement algorithm) is graded with 8 points.
- The best solution will be graded with 10.
  The worst solution will be graded with 8 (if it is an improved version of the initial feasible one).
- The rest of the solutions will be linearly graded according to their objective score.