

Entry Assessment II

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April 2024

Instructions

Assessment Instructions:

- **Programming Language/Tool:** Use the programming language or tool that you are most comfortable with. We understand that multiple approaches can be developed/applied to solve this problem. Remark that we prefer to see one complete implementation rather than several partial ones.
- **Assumptions:** Clearly state any assumptions you have made about the data or the problem in your report.
- **Discussion:** Be prepared to discuss the questions presented in Part II and Part III of the assessment.

We expect to receive back:

- A clearly written report of your method and respective results. We prefer a paper-like report.
- The source code of your implementation. All your results must be **reproducible**.

Problem

Given a set of nodes $V = \{0, 1, \dots, n+1\}$ and the distance between each pair of nodes $i \in V$ and $j \in V$ given as d_{ij} . A feasible path should satisfy the following constraints:

- the path must begin at node 0 and ends at node $n+1$
- each node is visited exactly once
- travelling from node $i \in V \setminus \{0, n+1\}$ to node $j \in V \setminus \{0, n+1\}$ is forbidden if (i) i is an even number, (ii) j is an odd number, and (iii) $i < n/2$

- travelling from node $i \in V \setminus \{0, n+1\}$ to node $j \in V \setminus \{0, n+1\}$ is forbidden if (i) i is odd, (ii) j is even, and (iii) $i \geq n/2$

Find the feasible path that minimises the function $(n\Delta \max_{i,j \in V} d_{ij} + D)$, where D is the total distance of the route, and Δ is the difference between the longest and the shortest node pair distance of a given path.

For instance, consider the path $0 - 3 - 1 - 2 - 4$ with respective node pair distances $d_{03} = 10, d_{31} = 5, d_{12} = 8, d_{24} = 7$, then $D = 30$ and $\Delta = d_{03} - d_{31} = 5$.

Part I

Design and code a program that can read a csv file of the form:

Node_ID	X-cor	Y-cor
0	40.8	24.1
1	82	10
2	34.12	23.1

Calculate the Euclidean distances between nodes and rounded up to the first decimal place. Provide a solution to the above problem in a txt file using the following format:

Path : 0 - 1 - 2 - 3 - 4 - 5
Total distances : 2323.12

Part II

Be prepared to discuss the following questions:

- Q1) How is your method scaling?
- Q2) What is the required time by your method to get a good solution?
- Q3) How would you change your method if you were asked to significantly reduce the computational time?
- Q4) How would you change your method to deal with dynamic arrival of requests?
- Q5) What aspects of the problem could be enhanced to include stochastic information?