Assignment: TSP

**MAKERERE** **UNIVERSITY**

****

**TRAVEL SALESMAN PROBLEM REPORT (TSP):**

**(Using Classical & SOM-Based Methods)**

Instructor (**Mr. Denish**): MAKERERE UNIVERSITY

By:

**GROUP\_S**

COLLEGE OF COMPUTING AND INFORMATION SCIENCES

SCHOOL OF COMPUTING AND INFORMATICS TECHNOLY

DEPARTMENT OF COMPUTER SCIENCE

BACHELOR OF SCIENCE IN COMPUTER SCIENCE (Year One)

(CSC: 1204). Data Structures & Algorithms Assignment of **Travel Salesman Problem (TSP) Using Classical & SOM-Based Methods.**

**semester II** Academic Year:

**2024:**

**Due date: 25TH March 2025**

# Assignment Team Members

|  |
| --- |
| Name REG.NO Role/Responsibility |

|  |  |  |
| --- | --- | --- |
| 1. Seanice Nabasirye   (0770862549) | 24/U/22871/PS | Representation & Data Structures |
| 1. Asiimwe Isaac   (0770563394) | 24/U/03765/PS | Assignment Task Manager. |
| 1. Kiyingi Solomon Jessy   (0767594340) | 24/U/25920/EVE | Analysis and Comparison |
| 1. Jonah Akandwanaho   (0756348528) | 24/U/03053/PS | SOM-Based Approach |
| 1. Keith Paul Kato   (0759021371) | 24/U/26593/EVE | Assignment Report/Documentation |
| 1. Isaac |  | Analysis and Comparison |

# **Task 1: Representation & Data Structures:**

The **(TSP)** can be effectively represented using an **Adjacent Matrix Approach,** a data structure most appropriate for storing the graph representation of the city and the distances. It uses a 2D-Array matrix that can also be used for a dense graph where all nodes are connected as illustrated by the graph representation of the city distances **STRUCTURE OF ADJACENT MATRIX APPROACH.**

The graph representation of cities and distances has 7 cities therefore a (**7\*7)** matrix is used. In addition to that if there’s no direct route between any city, so we set matrix **[i][j]** = **∞** which means “Infinite distance” or “no connection between the cities” where i and j are cities. Furthermore, since the graph is undirected (there can be a route to and from two cities i.e., from city 1 to city 2 & vice versa), the matrix is symmetric, implying (**matrix[i][j]** = **matrix[j][i]**). With diagonal elements set to **zero (0)**. This representation allows efficient look up. **REASONS FOR CHOOSING ADJACENT MATRIX APPROACH.**

1. The adjacent matrix is good for dense graphs, it efficiently stores all connections.
2. Checking if an edge exists between **2 nodes** is **O(1). O(1)** means that, the operation takes the same amount of time regardless of how many elements are in the data structure.
3. It is easy to implement using a **2D** array.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 0 | 12 | 10 | ∞ | ∞ | ∞ | 12 |
| 2 | 12 | 0 | 8 | 12 | ∞ | ∞ | ∞ |
| 3 | 10 | 8 | 0 | 11 | 3 | ∞ | 9 |
| 4 | ∞ | 12 | 11 | 0 | 11 | 10 | ∞ |
| 5 | ∞ | ∞ | 3 | 11 | 0 | 6 | 7 |
| 6 | ∞ | ∞ | ∞ | 10 | 6 | 0 | 9 |
| 7 | 12 | ∞ | 9 | ∞ | 7 | 9 | 0 |

**TSP objectives.**

* The traveler must visit each and every city without leaving any unvisited.
* The traveler has to get back to the starting point after each and every visit of the cities.
* The traveler must make sure that the travelled distance is the least possible option that allows all cities to be visited.

**Assumptions of the TSP.**

* Each city is visited exactly only once without repeating.
* Only the starting point/city is the only city visited twice which is a return visit.
* The travel is a cycle, in that, the visits eventually return back to the starting point.
* Every city can be reached from any other city where a connection exists; thus, the connections are bi-directional.
* The traveler has no time constraints