



DA2

-DIOGO SANTOS (UP202009291) – 50%

-RAFAEL VALQUARESMA (UP202104805) – 50%

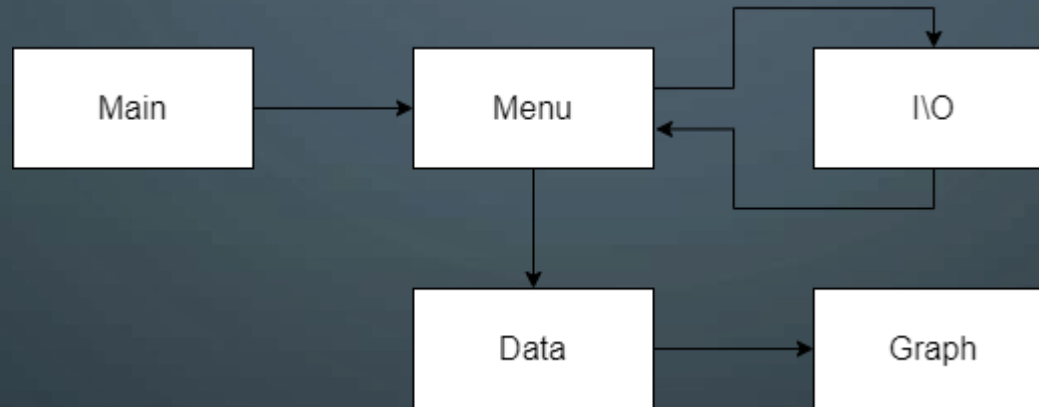
PROBLEM DESCRIPTION

- Routing Algorithm for Ocean Shipping and Urban Deliveries
- Developing and analyzing a set of approximate solutions to the TSP

SOLUTION DESCRIPTION

- Creation of the *Menu* class to interact with the user
- Creation of the *Data* class that receives the provided data
- Creation of the *Graph* class, alongside the *Edge* and *Node* structs inside it, to implement the main functions

CLASS DIAGRAM



IMPLEMENTED FUNCTIONALITIES

- **Menu.h:**
- **Menus:**
- **SelectGraphMenu** – First menu to appear where the user selects the graph desired
- **MainMenu** – Main menu where user can select the main functionalities implemented
- **InfoMenu** – Menu used to print information about the graph
- **Auxiliary functions:**
- **printTitle** – Function that prints this project's title
- **getUserInput** – Function that receives the user's input
- **clearScreen** – Function that clears the terminal
- **print** – Functions used to print certain data as a table or as a path

IMPLEMENTED FUNCTIONALITIES

- Data.h:
- Data Reading functions:
 - **readRealGraphs** – Reads one of the 3 real graphs in the datasets folder
 - **readToyGraphs** – Reads one of the 3 toy graphs in the datasets folder
 - **readExtraGraphs** – Reads one of the 12 extra graphs in the datasets folder
- Variable getters:
 - **getGraph** – Returns the Graph graph
 - **getRealGraph** – Returns the Boolean realGraph
 - **getExtraGraph** – Returns the Boolean extraGraph
 - **getHasName** – Returns the Boolean hasName

IMPLEMENTED FUNCTIONALITIES

- Graph.h:
- Graph builders:
 - **addNode** – Adds nodes to the graph
 - **addEdge** – Adds edges to the nodes
- Variable getters:
 - **getNodes** – Returns the object nodes
 - **getEdgesOut** – Returns the vector edgesOut of a node
- Auxiliary functions:
 - **convertToRad** – Returns the radian equivalent of a degree
 - **distanceBetweenNodes** – Returns the calculated distance between two nodes
 - **getTourDistance** – Returns the total distance travelled in the cycle provided for the real graphs
 - **toyAndExtraComputeDistance** – Returns the total distance travelled in the cycle provided for the other graphs

IMPLEMENTED FUNCTIONALITIES

- Graph.h:
- Algorithms:
 - **hamiltonianCycle** – Calls the **hamiltonianCycleUtil** function after initializing the needed variables
 - **hamiltonianCycleUtil** – Backtracking approach to the TSP problem
 - **triangularApproximationHeur** – Triangular Approximation approach to the TSP problem
 - **triangularApproximationHeurToy** – Triangular Approximation approach to the TSP problem for the Toy graphs
 - **sosACO** – Self-Organizing System based Ant Colony Optimization approach to the TSP
 - **primMST** – Finds the minimum spanning tree of a graph using Prim's algorithm

HIGHLIGHTS

- Menu:
 - Visually clean and elegant user interface
 - Easy and perceptible results
- Graph:
 - Reasonably fast algorithms with good-ish results

PROBLEMS

- Graph:
 - The distance values obtained through our algorithms vary and sometimes are quite ridiculous and outright wrong