



Air Travel Flight Management

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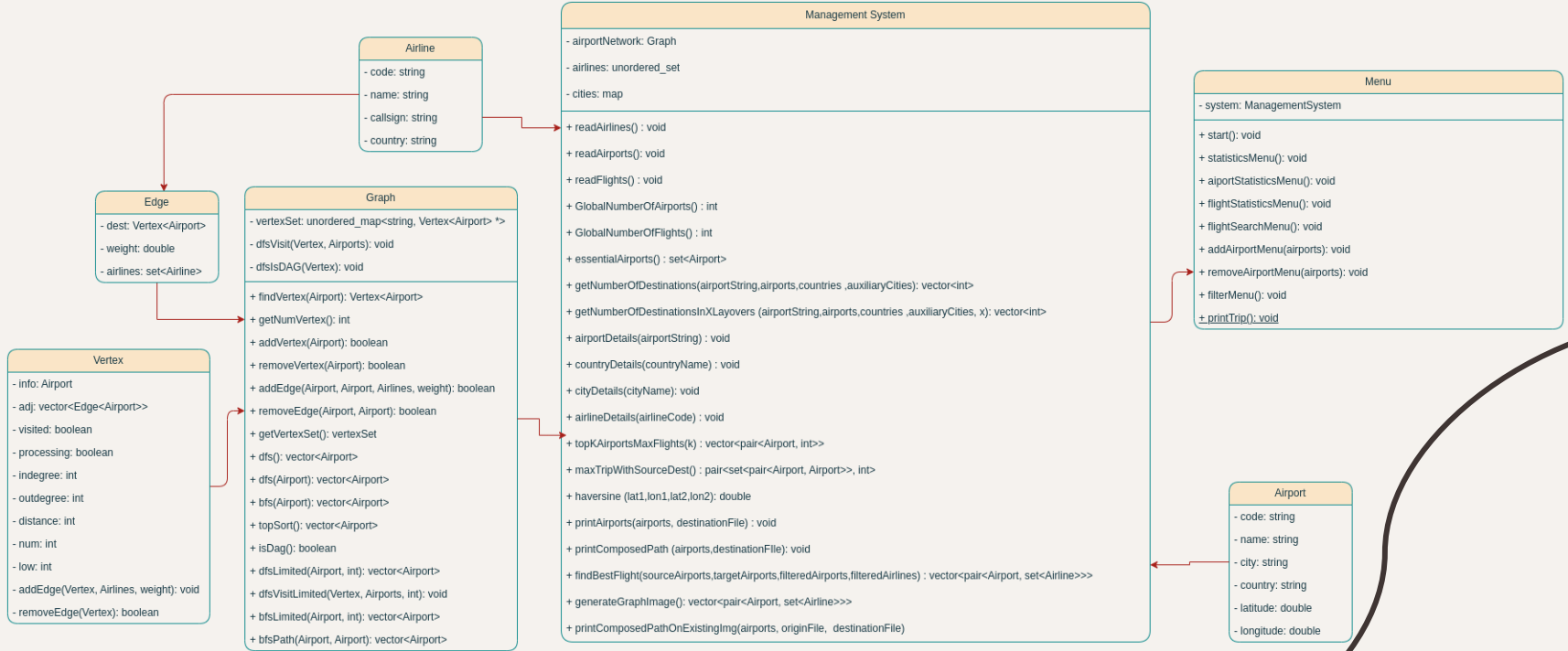
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Introduction

Overview of the structure

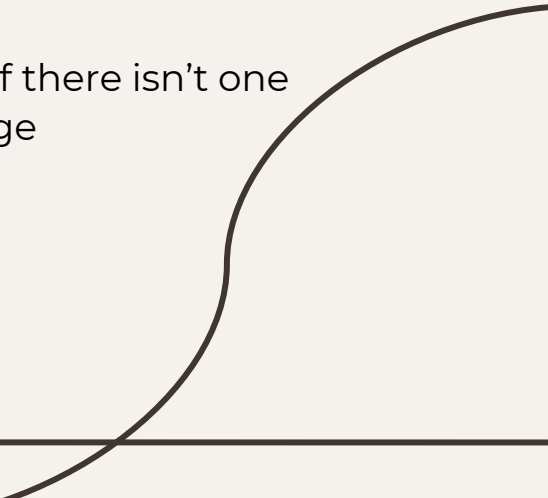


Reading the dataset

-Read Airlines -> read airlines from airlines.csv and add to the unordered_set airlines

-Read Airports -> read airports from airports.csv, create a vertex with each airport and store the vertices in an unordered_set

-Read Flights -> read flights from flights.csv and add a new edge if there isn't one between the airports already and if there is add the airline to the edge

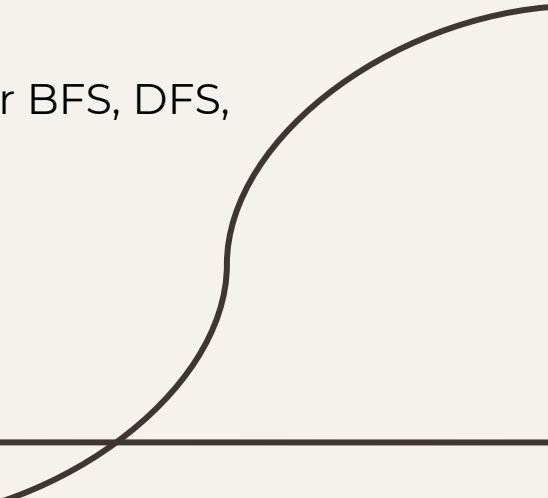


Graph description

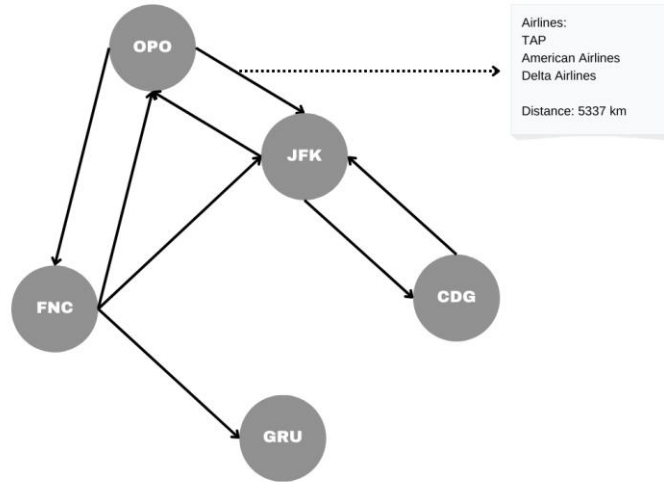
-**Vertex** – Represents each Airport in the network

-**Edge** – Represents each Flight from one Airport to another
In addition it holds the values of the different airlines that fly that route

In addition the Graph has many helper functions for BFS, DFS, sorting(TopSort), cycle detection , etc..



Visual Representation of Graph



Implemented Functionality (3)

- Display **Global number of airports** by returning the number of vertices $O(1)$ and the **number of flights** by iterating over the vertices and then over the edges and adding for each edge the number of airlines $O(|V|*|E|)$
- Print the **essential airports** using the algorithm for finding articulation points presented in the theoretical classes based on the Tarjan algorithm $O(|V|*|E|*K)$
- Print number of **possible destinations** from an airport $O(|V|+|E|)$ and **reachable destinations** from an airport in **X layovers** $O(|V|+|E|)$ both implemented with using DFS

Implemented Functionality (3)

- Display **details** of a given **airport** for instance number of **flights, countries and airlines** $O(|E|*K)$
- Display **details** of a given **country** for instance number of **flights, countries and airlines** $O(|E|*K*L)$
- Display **details** of a given **city** for instance number of **flights , countries and airlines** $O(|E|*K*L)$
- Display **details** of a given **airline** for instance number of **flights and airports** $O(|V||E|)$

Implemented Functionality (3)

- Display the **top k airports** with the maximum number of flights $O(|V|*|E|+\log(V))$
- Find **max Trip** (diameter of the graph) using BFS $O(|V|*(|V|+|E|))$

-



Implemented Functionality (4-5)

- Function uses the **haversine distance** to calculate distance between 2 points on a sphere.
- Display the **best flight options** for a trip with filtering functionality using BFS $O(|V|*(|V|+|E|))$

Implemented Functionality (4-5)

Source

```
What do you want to add?  
1) Single Airport  
2) All airports of a city  
3) All airports of a country  
4) Airport by coordinates  
5) Go back
```

Destination

```
What do you want to add?  
1) Single Airport  
2) All airports of a city  
3) All airports of a country  
4) Airport by coordinates  
5) Go back
```

Network of flights

```
1) Add airport to excluded airports  
2) Remove airport from excluded airports  
  
3) Add airline to excluded airlines  
4) Remove airline from excluded airlines  
|  
5) Add Airport to layover airports  
6) Remove airport from layover airports  
  
7) Add airline to allowed airlines  
8) Remove airline from allowed airlines
```

User Interface

What do you want to do?

- 1) Get statistics about the flight network
- 2) Search for a flight
- 3) Exit

Please enter the name of the country

Portugal

Details for Portugal:

There are 14 airports in Portugal:

Lisboa (LIS) located in Lisbon with 103 outgoing flights

Faro (FAO) located in Faro with 62 outgoing flights

Porto (OP0) located in Porto with 61 outgoing flights

Madeira (FNC) located in Funchal with 29 outgoing flights

Ponta Delgada (PDL) located in Ponta Delgada with 17 outgoing flights

Lajes (TER) located in Lajes (terceira Island) with 8 outgoing flights

Horta (HOR) located in Horta with 5 outgoing flights

Flores (FLW) located in Flores with 4 outgoing flights

The best trip with the current filters is:

OP0 YYZ JFK

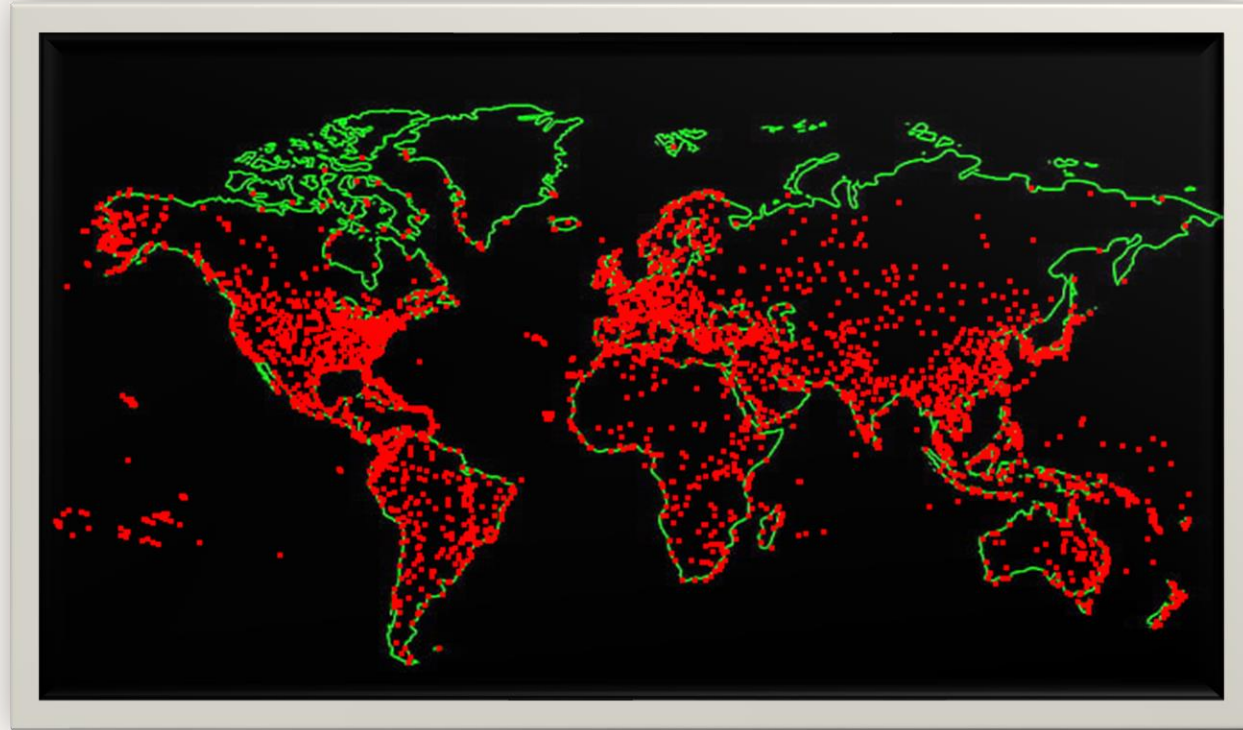
Currently selected departure airports:

Code: OP0, Name: Porto, City: Porto, Country: Portugal, Coordinates: 41.25 -8.68

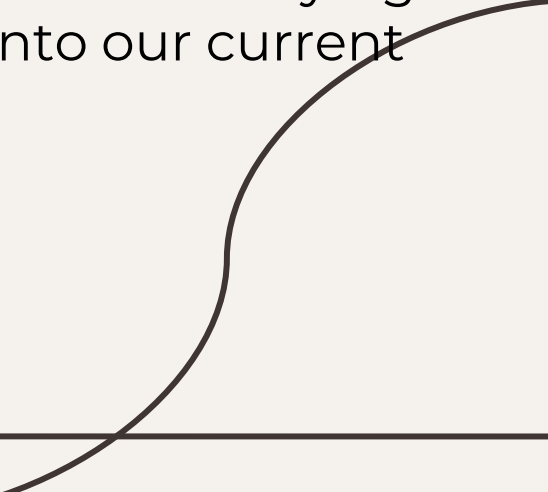
Currently selected arrival airports:

Code: JFK, Name: John F Kennedy Intl, City: New York, Country: United States, Coordinate

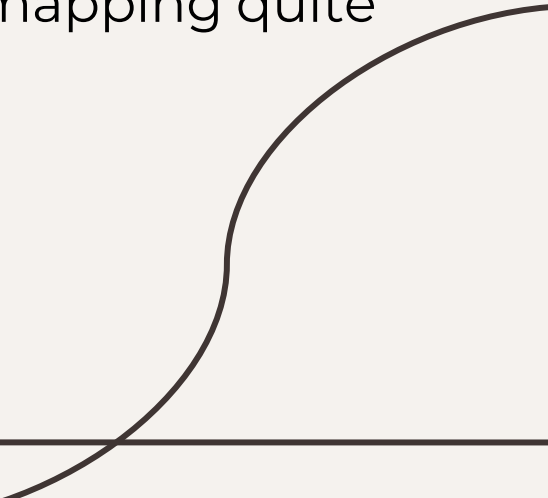
Proud Features- Image System Interface



Valorization tasks – Modifying Images

- We wanted a way to actually visualize the data we were dealing with in order to make it more appealing and easier to understand
 - In the 1st year we developed another project for modifying PNG files so we simplified and integrated it into our current project
- 

Valorization tasks – Mapping coordinates to Image

- Started with basic linear approximation between the physical coordinates and the image coordinates (worked well for longitude but not that well for latitude)
 - Used a function based on the Miller Projection which fixed the problem with longitude and made the mapping quite accurate
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Valorization tasks – Print Path

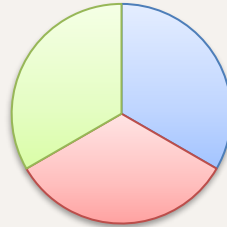
-We also developed functionality that prints a path from one place to another therefore allowing the user to visualize the path from the find the best path functionality, this path adjust for the curvature of the earth



Problems we faced

- Displaying the path
- Naming
- Confirming our results

Participation



■ Jose ■ Leandro ■ Henrique

Conclusion!
