Air Travel Flight Management System - AED 23/24

Grupo G110
Composto por:
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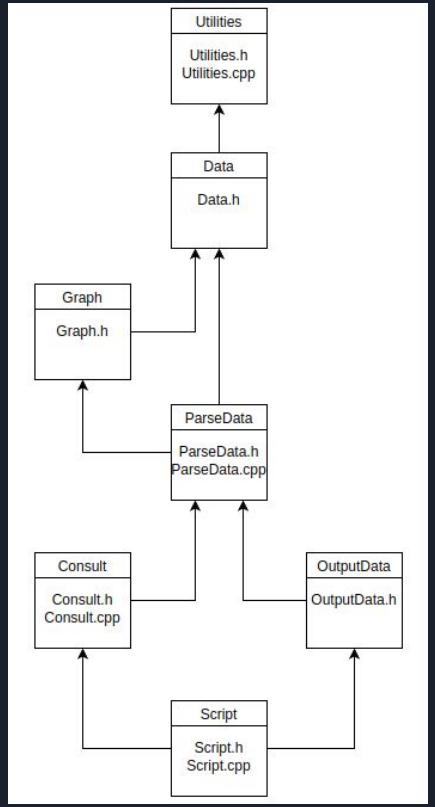
Class Diagram



Dataset reading description

At first, we read and parse all the information from the file “airlinesCSV”, extract it, create an airline object and insert it into a set data structure called “airlinesInfo”.

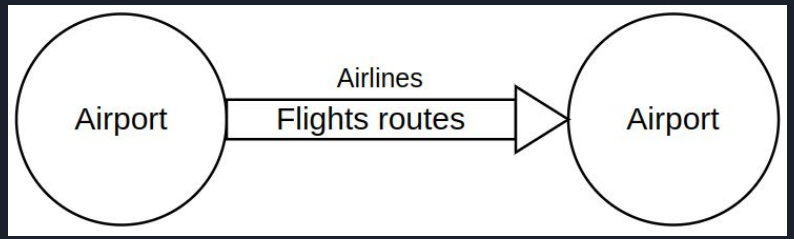
After it, we read and parse all the information from the file “airportsCSV”, extract it, create an airport object and add it into a graph data structure called “dataGraph”.

Lastly, we read and parse all the information from the file “flightsCSV”, extract it, and them we retrieve airports information from the graph “dataGraph”, add an edge between source and target airports, increment a flight count and associate an airline for the corresponding edge.

Graph description

Our graph is composed by:

- Airports representing vertex.
- Flight routes representing edges.
- Airline flights representing tags for edges.



List of implemented functions

- Smallest path between Airports:

  Algorithm: Utilizes BFS

  Complexity: O(V + E)

- Find Closest Airports:

  Iterates through all airports, calculates the Haversine distance to each airport, and identifies the closest ones.

  Complexity: O(V * log(V))

- Essential Airports:

  Algorithm: Utilizes DFS

  Complexity: O(V + E)

V - Represents number of Vertex
E - Represents number of Edges

List of implemented functions

- Number of reachable Airports/Cities/Countries in X stops from airport:

  Algorithm: Utilizes BFS

  Complexity: O(V + E)

- Maximum trip :

  Algorithm: Utilizes BFS

  Complexity: O(V * (V + E))

- Number of Flights per City/Airline:

  Algorithm: Utilizes DFS

  Complexity: O(V + E)

V - Represents number of Vertex
E - Represents number of Edges

List of implemented functions

- Top traffic capacity Airports:

  Identifies airports with the highest traffic capacity

  Complex: O(V * log(V))

- Find Airports by Airports/City/Country name:

  Complex: O(V * M * log(V)), where M is the length of the string name

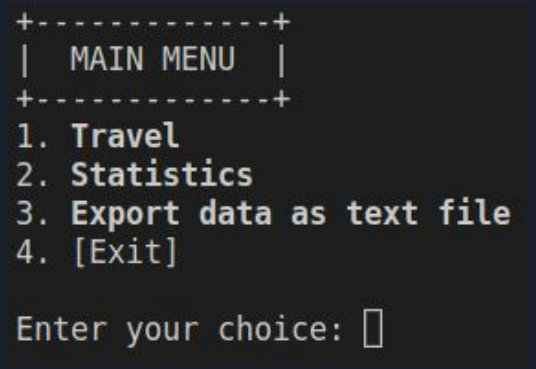
- Find Airports by Code:

  Complex: O(V * C), where C is the length of the code

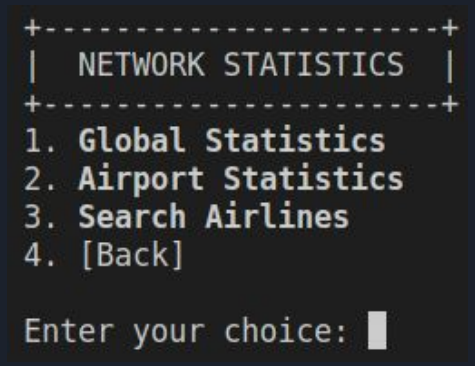
V - Represents number of Vertex
E - Represents number of Edges

User interface

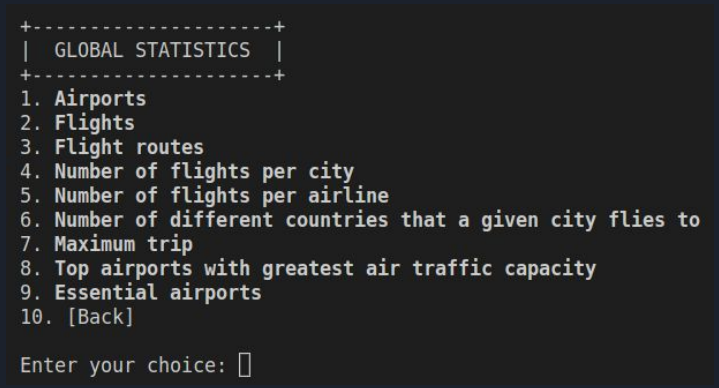
Just some examples



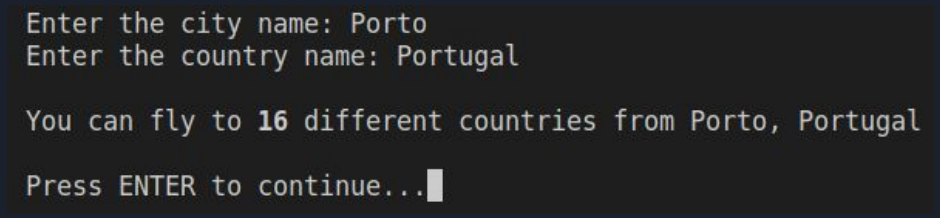
Pressing 2



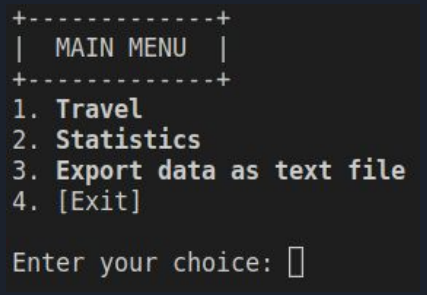
Pressing 1



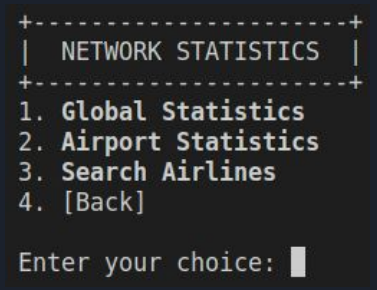
Pressing 6 and typing “Porto” and “Portugal”



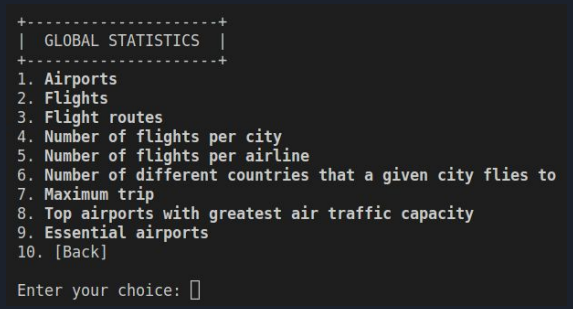
User interface



Pressing 2



Pressing 1



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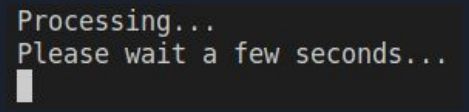
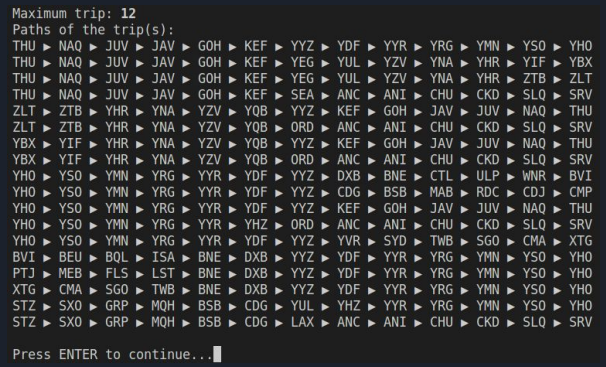
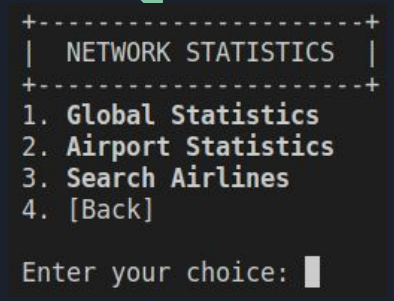
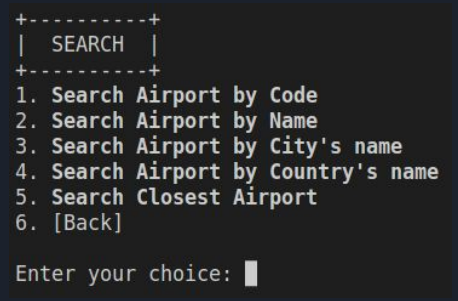




User interface

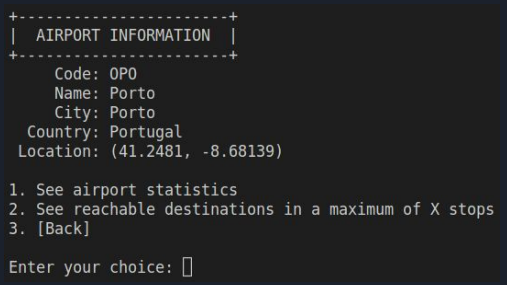


Pressing 2

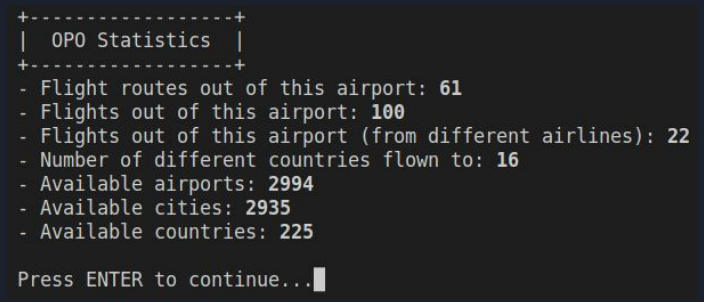


Pressing 1

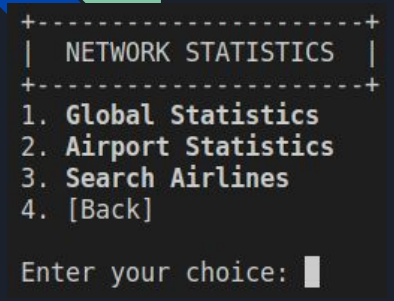
Typing “OPO”

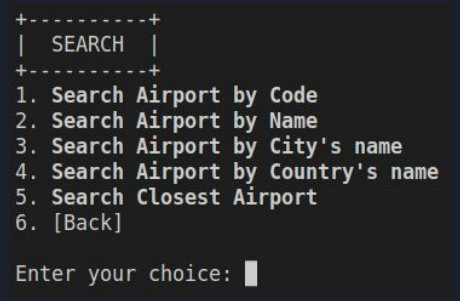


Pressing 1



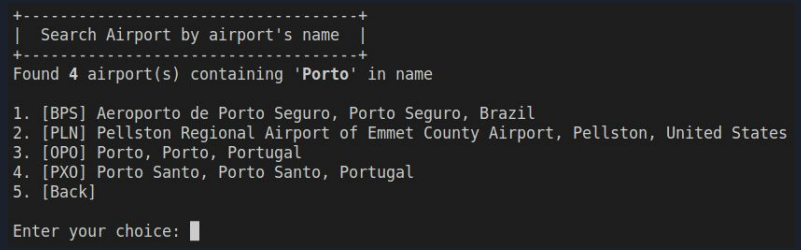
User interface

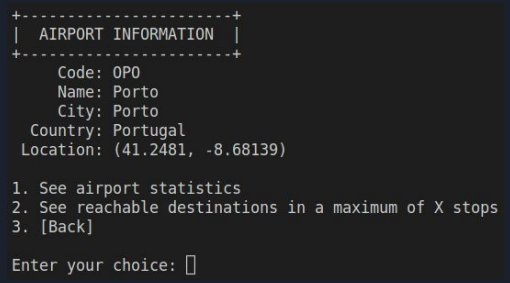




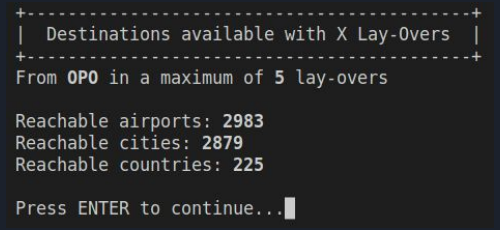
Pressing 2

Typing “Porto” and pressing 3

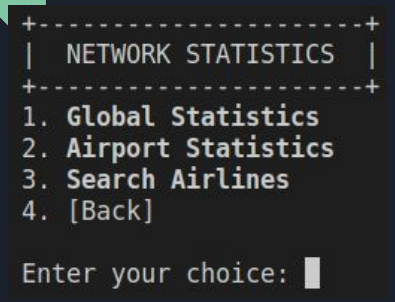




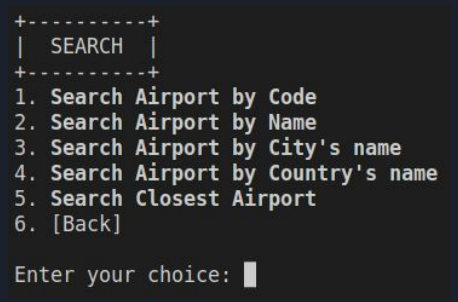
Pressing 2 and typing 5



User interface

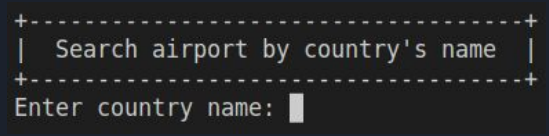


Pressing 2



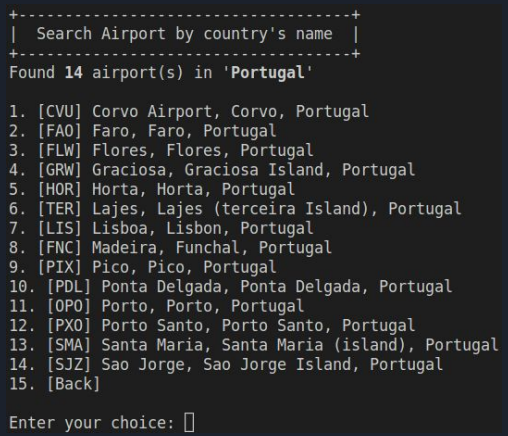
Pressing 2

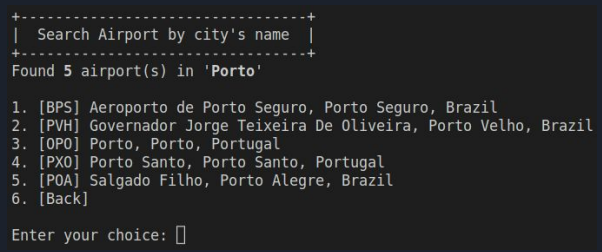
Pressing 4

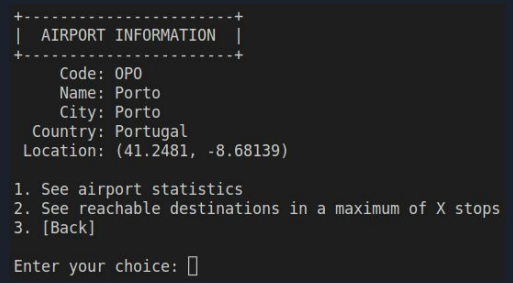


Typing “Portugal”

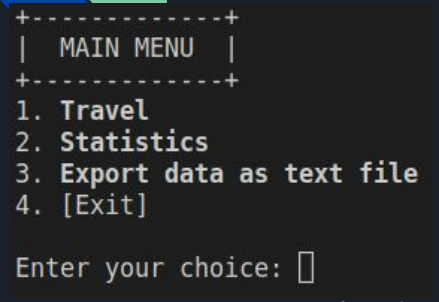
Typing “Porto” and pressing 3







User interface



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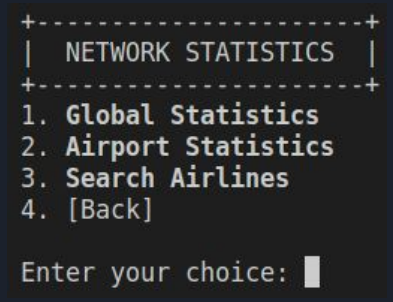
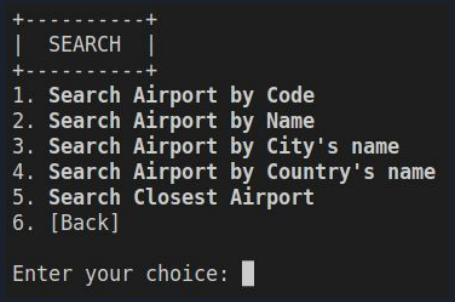
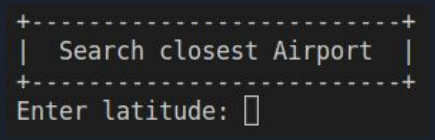


Pressing 2

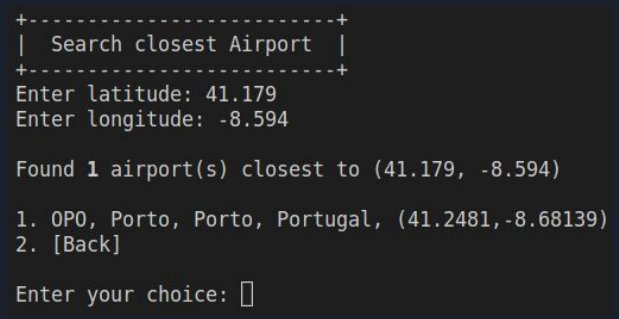


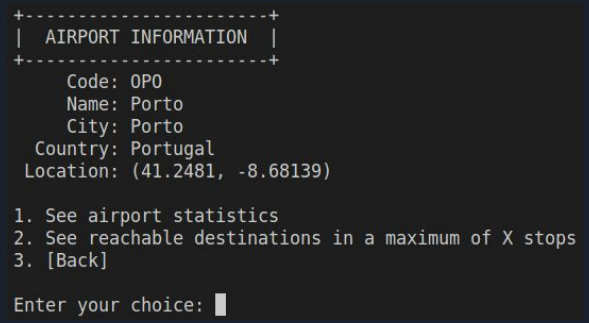
Pressing 5



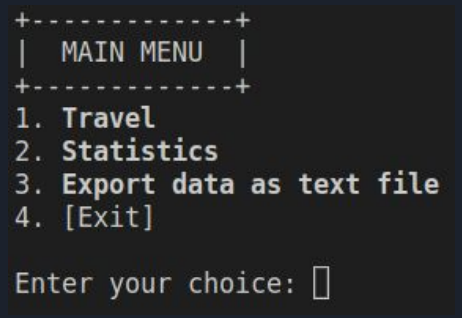
Typing “41.179, -8.594” (FEUP coordinates)

Pressing 1

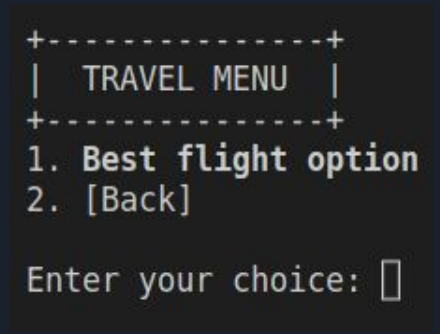




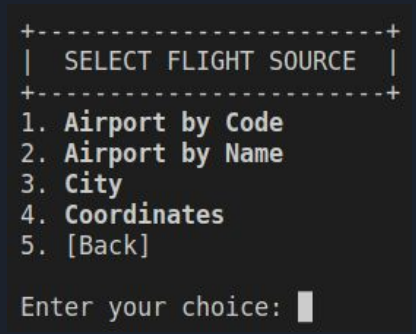
User interface



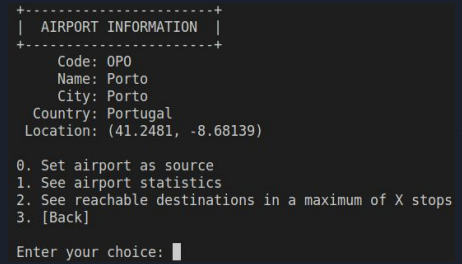
Pressing 1



Pressing 1



Pressing 2



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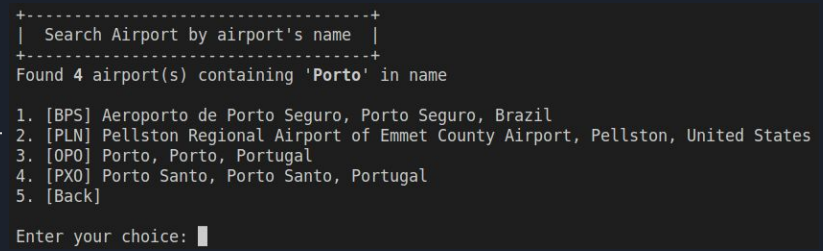
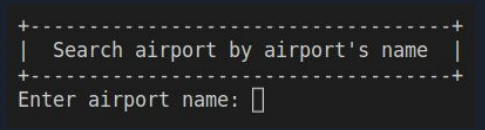


Pressing 3



Typing “Porto”

User interface

Continuation of the previous example..

```
+----------------+
|  Extra filters  |
+----------------+
1. Show best flights
2. Add custom layovers
3. [Back]

Note: option 2 is to add specific layover airports that your flight must pass through

Enter your choice:
```

Pressing 1

```
+---------------+
|  Best Flights  |
+---------------+
Source: OPO, Porto, Porto, Portugal, (41.2481,-8.68139)
Destination: Brussels, Belgium

1. Best flights in the same airline
2. Best flights considering all airlines
3. [Back]

Enter your choice:
```

Pressing 1

```
+---------------------------+
|  SELECT FLIGHT DESTINATION  |
+---------------------------+
Source: OPO, Porto, Porto, Portugal, (41.2481,-8.68139)

1. Airport by Code
2. Airport by Name
3. City
4. Coordinates
5. [Back]

Enter your choice:
```

Pressing 3

```
+------------------+
|  Search by city  |
+------------------+
Enter city name:
```

```
+------------------+
|  Search by city  |
+------------------+
Enter city name: Brussels
Enter country name:
```

Typing “Brussels” and “Belgium”

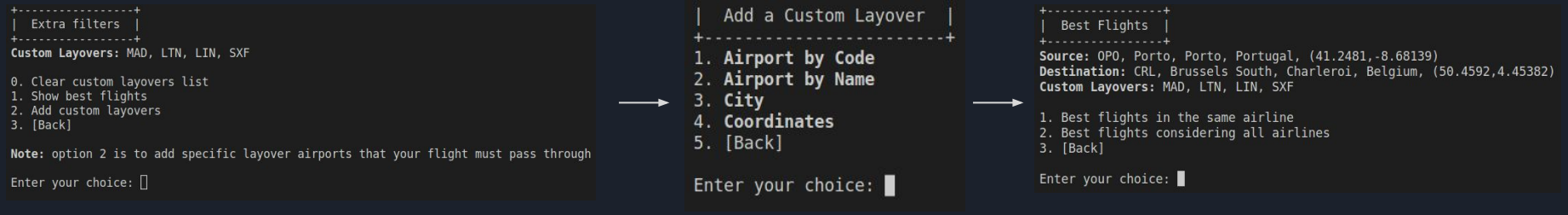
```
Source: OPO, Porto, Porto, Portugal, (41.2481,-8.68139)
Destination: Brussels, Belgium

Best flight is with 0 lay-over(s)
1. OPO ▶ BRU   (1473.4 km)
2. [Back]

Enter your choice:
```

Pressing 1

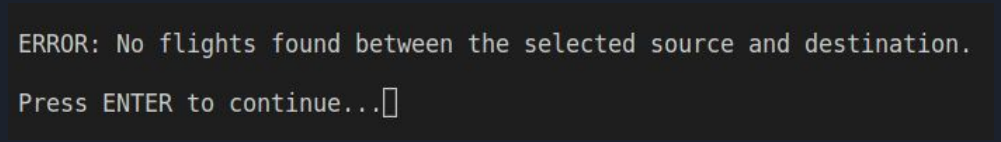
```
+-------------------------+
|  Details about the trip  |
+-------------------------+
Total distance: 1473.4 km

1. OPO, Porto, Porto, Portugal, (41.2481,-8.68139)
   [Available Airlines]: DAT, FOS, IBE, RYR, TAP
                ▼
2. BRU, Brussels Natl, Brussels, Belgium, (50.9014,4.48444)


Press ENTER to continue...
```

Highlight function

The filter “Custom Layovers” is our highlight of this project, it works implementing layovers when searching for best flights options. In short, you can choose an airport as source and an airport as destination, after that you can add as many layovers as you want between these airports.



For example, in this situation it was added four obligatory layovers between Porto and Brussels, if you choose the best flights in the same airline, none would be found, but if you consider all airlines you would find more than 4000 choices, as you can see in the next slide.



Highlight function

```
4044. OPO ▶ MAD ▶ LTN ▶ CTA ▶ LIN ▶ MAD ▶ SXF ▶ LPA ▶ CRL   (14401.3 km)
4045. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ ARN ▶ SXF ▶ TFS ▶ CRL   (14421.2 km)
4046. OPO ▶ MAD ▶ LTN ▶ MLA ▶ LIN ▶ MAD ▶ SXF ▶ FUE ▶ CRL   (14421.5 km)
4047. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ MAD ▶ SXF ▶ ACE ▶ CRL   (14447.7 km)
4048. OPO ▶ MAD ▶ LTN ▶ MLA ▶ LIN ▶ DUB ▶ SXF ▶ TFS ▶ CRL   (14496 km)
4049. OPO ▶ MAD ▶ LTN ▶ CTA ▶ LIN ▶ MAD ▶ SXF ▶ TFS ▶ CRL   (14501 km)
4050. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ DUB ▶ SXF ▶ LPA ▶ CRL   (14542.4 km)
4051. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ MAD ▶ SXF ▶ FUE ▶ CRL   (14567.7 km)
4052. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ DUB ▶ SXF ▶ TFS ▶ CRL   (14642.2 km)
4053. OPO ▶ MAD ▶ LTN ▶ MLA ▶ LIN ▶ MAD ▶ SXF ▶ LPA ▶ CRL   (14672 km)
4054. OPO ▶ MAD ▶ LTN ▶ MLA ▶ LIN ▶ MAD ▶ SXF ▶ TFS ▶ CRL   (14771.8 km)
4055. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ MAD ▶ SXF ▶ LPA ▶ CRL   (14818.2 km)
4056. OPO ▶ MAD ▶ LTN ▶ OTP ▶ LIN ▶ MAD ▶ SXF ▶ TFS ▶ CRL   (14918 km)
4057. [Back]

Enter your choice:
```

You can choose any of these 4056 options, in this case it was chosen the option 4051, showing all the details of that trip.

```
+-------------------------+
|  Details about the trip  |
+-------------------------+
Total distance: 14567.7 km

1. OPO, Porto, Porto, Portugal, (41.2481,-8.68139)
   [Available Airlines]: IBE, RYR, RZO, TAP, THA, USA
                ▼
2. MAD, Barajas, Madrid, Spain, (40.4936,-3.56676)
   [Available Airlines]: EZY
                ▼
3. LTN, Luton, London, United Kingdom, (51.8747,-0.368333)
   [Available Airlines]: WZZ
                ▼
4. OTP, Henri Coanda, Bucharest, Romania, (44.5722,26.1022)
   [Available Airlines]: AZA, ROT
                ▼
5. LIN, Linate, Milan, Italy, (45.4451,9.27674)
   [Available Airlines]: IBE
                ▼
6. MAD, Barajas, Madrid, Spain, (40.4936,-3.56676)
   [Available Airlines]: EZY
                ▼
7. SXF, Schonefeld, Berlin, Germany, (52.38,13.5225)
   [Available Airlines]: CFG
                ▼
8. FUE, Fuerteventura, Fuerteventura, Spain, (28.4527,-13.8638)
   [Available Airlines]: RYR
                ▼
9. CRL, Brussels South, Charleroi, Belgium, (50.4592,4.45382)


Press ENTER to continue...
```

Effort of each member of the group

Bruno Huang - 40%

Gabriel Moura - 20%

Ricardo Yang - 40%