

CS225 Project Openflight

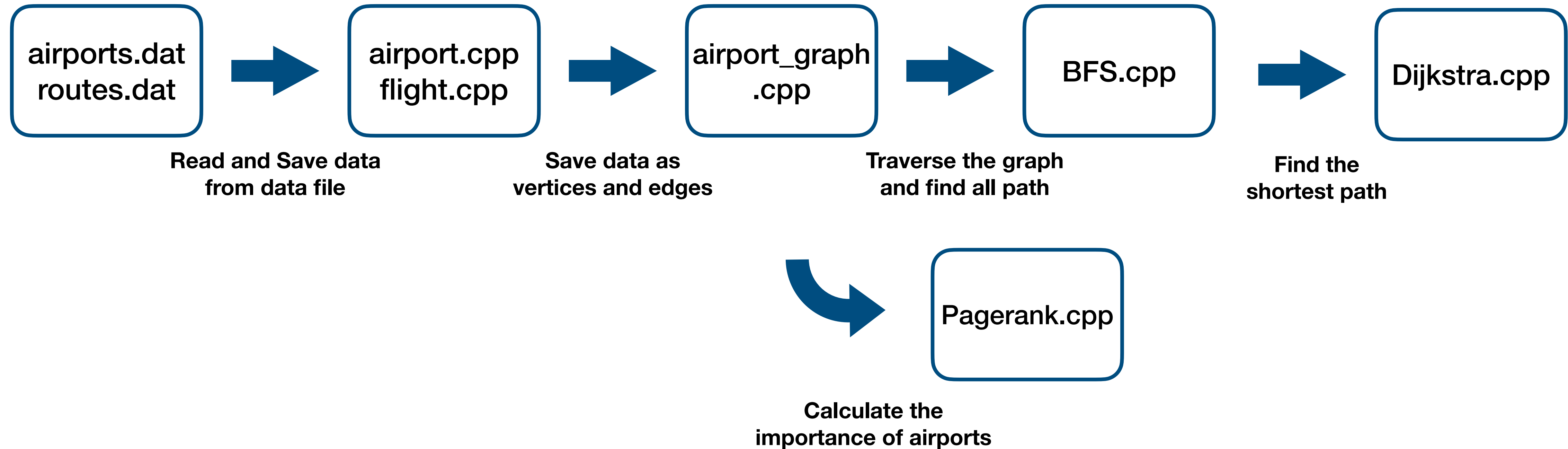
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Goal of the Project

Using routes and airport data from openflights.org, we tried to find out **paths from an airport to another airport**.

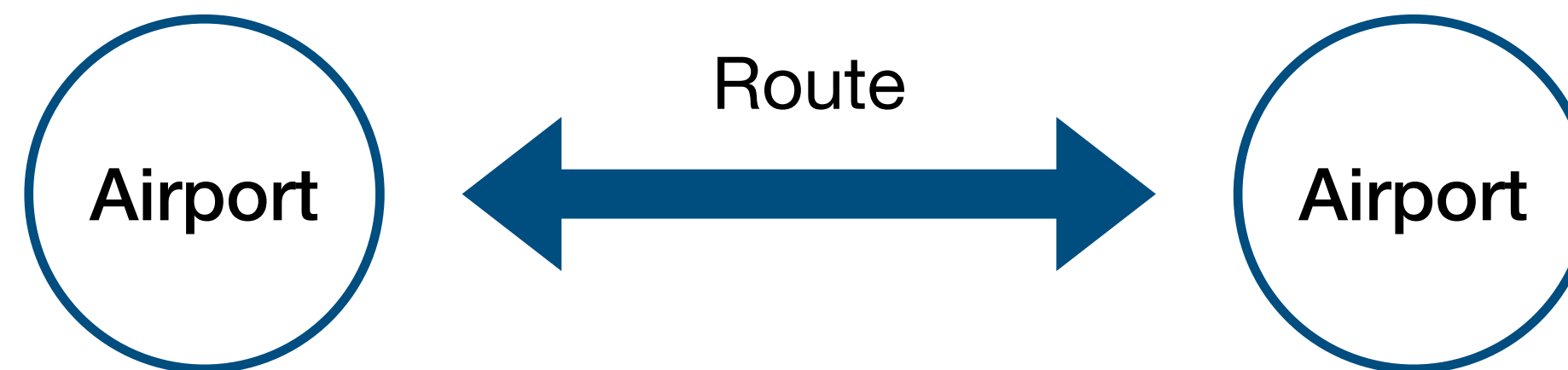
Also, our goal is to find out the **shortest path** and the **importance of each airport** through this project.

Project Flowchart



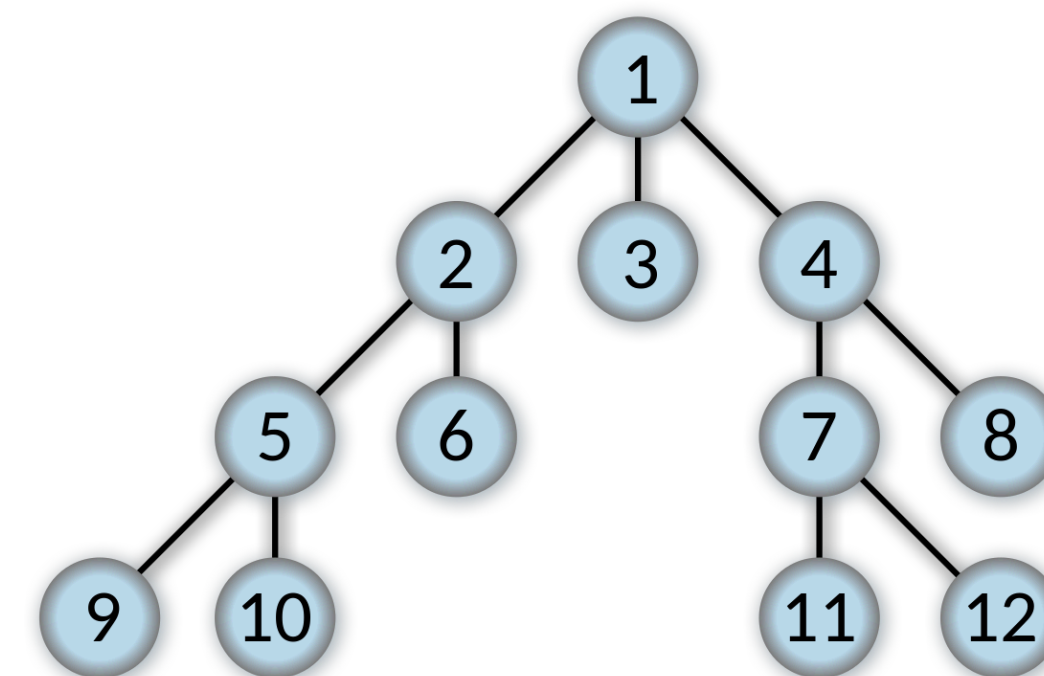
Airport, Flight, and Airport_graph Development

- Downloaded airports.dat, routes.dat from openflight.org
- Opened the data and stored the data in airport.cc, flight.cc
- Create graph and insert airports in vertices and routes in edges in [airport_graph.cc](#)
- Tried to make a destination recommendation algorithm but couldn't find out the weather data for all airports.



BFS Traversal Development

- Traversed airport_graph we made from the data through Breadth First Search Traversal method.
- Used `std::queue` to save data while traversing.
- Found out all the paths from one airport.
- Found out all the paths from one airport to another airport.

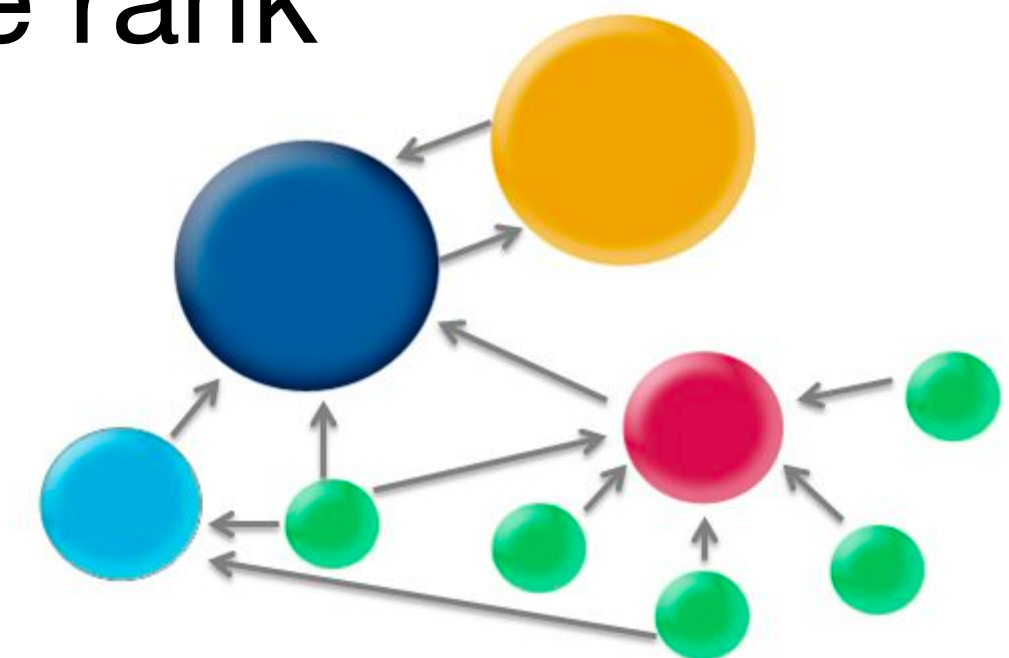


Dijkstra's algorithm Development

- Select two airports (departure, destination) and find path between them.
- Calculated path length of the paths between airports.
- Showed the shortest path.

PageRank's algorithm Development

- An algorithm used to measure the importance of each data by weighting the connected data according to its relative importance.
- Got adjacent matrixes for the graph we made
- Normalized the matrix and calculated PageRank with damping factor.
- For the output, we got the importance of each airport in vector.
- Understanding the formula of page rank and applying was quite challenging.
- Overcame through reading many documents about page rank



Conclusion

- Found out all the paths from an airport using BFS.

```
• (base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % make all
  clang++ Airport.o main.o PageRank.o airport_graph.o Flight.o Djikstras.o BFS.o -std=c++14 -stdlib=libc++ -lc++abi -lm -o openflight
○ (base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % ./openflight

CS225 Final Project: OpenFlights
Enter "default" to construct graph using datasets from OpenFlights.org
or enter name of airports dataset
default
Enter a number to select an operation:
(0) Using BFS, traverse all of the graph from a given airport
(1) Using BFS, traverse a given number of moves of the graph from a given airport
(2) Using BFS, traverse the graph until a destination airport from a given airport
(3) Calculate the shortest path between two airports
(4) PageRank
0
Enter a source airport ID:
3830
Printing out traversal from Chicago O'Hare International Airport:
Chicago O'Hare International Airport -> Miami International Airport -> Düsseldorf Airport -> Yeager Airport -> Newark Liberty International Airport ->
Gallatin Field -> Bishop International Airport -> Munich Airport -> Wilkes Barre Scranton International Airport ->
```


Conclusion

- Found out the paths from an airport with n times stop over using BFS.

```
(base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % make all
clang++ Airport.o main.o PageRank.o airport_graph.o Flight.o Dijkstra.o BFS.o -std=c++14 -stdlib=libc++ -lc++abi -lm -o openflight
(base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % ./openflight
```

CS225 Final Project: OpenFlights

Enter "default" to construct graph using datasets from OpenFlights.org

or enter name of airports dataset

default

Enter a number to select an operation:

(0) Using BFS, traverse all of the graph from a given airport

(1) Using BFS, traverse a given number of moves of the graph from a given airport

(2) Using BFS, traverse the graph until a destination airport from a given airport

(3) Calculate the shortest path between two airports

(4) PageRank

1

Enter a source airport ID:

3830

Enter moves to traverse:

3

Printing out first 3 moves from Chicago O'Hare International Airport:

Chicago O'Hare International Airport -> Miami International Airport -> Düsseldorf Airport -> Yeager Airport

Computation finished. Now restarting the program.

Conclusion

- Found out all the paths between airports using BFS.

```
(base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % make all
clang++ Airport.o main.o PageRank.o airport_graph.o Flight.o Djikstras.o BFS.o -std=c++14 -stdlib=libc++ -lc++abi -lm -o openflight
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(2) Using BFS, traverse the graph until a destination airport from a given airport
(3) Calculate the shortest path between two airports
(4) PageRank
2
Enter a source airport ID:
3494
Enter a destination airport ID:
3830
Printing out traversal from Newark Liberty International Airport to Chicago O'Hare International Airport:
Newark Liberty International Airport -> Vancouver International Airport -> Manchester Airport -> Miami International Airport -> Francisco de Sá Carneiro Airport ->
Minneapolis-St Paul International/Wold-Chamberlain Airport -> Hong Kong International Airport -> Shanghai Pudong International Airport -> Brussels Airport ->
Eppeley Airfield -> Chicago O'Hare International Airport

Computation finished. Now restarting the program.
```


Conclusion

- Calculated the shortest path between airports using Dijkstra's algorithm.

```
• (base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % make all
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(0) Using BFS, traverse all of the graph from a given airport
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(2) Using BFS, traverse the graph until a destination airport from a given airport
(3) Calculate the shortest path between two airports
(4) PageRank
3
Enter the name of source airport name,
or enter 'default' to use 'Newark Liberty International Airport' as start and 'Gold Coast Airport' as end:
default
Airports Visited:

Newark Liberty International Airport --> Montreal / Pierre Elliott Trudeau International Airport --> Bathurst Airport --> Sydney Kingsford Smith International Airport --> Gold Coast Airport

Total Distance: 2022.58 KM

Computation finished. Now restarting the program.
```


Conclusion

- Calculated the importance of each airport using PageRank algorithm.

```
• (base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % make all
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○ (base) jeongwoochoi@wirelessprv-10-193-89-117 openFlight % ./openflight

CS225 Final Project: OpenFlights
Enter "default" to construct graph using datasets from OpenFlights.org
or enter name of airports dataset
default
Enter a number to select an operation:
(0) Using BFS, traverse all of the graph from a given airport
(1) Using BFS, traverse a given number of moves of the graph from a given airport
(2) Using BFS, traverse the graph until a destination airport from a given airport
(3) Calculate the shortest path between two airports
(4) PageRank
4

enter the number of the most important airport to be printed:
5
top 5 important airport
1382
340
2188
580
507

Computation finished. Now restarting the program.
```

Conclusion

- Through this project, we have gained a deeper understanding of graph theory and the different algorithms used to solve shortest path problems. We also learned how to implement these algorithms in C++ programming language and how to deal with the real-dataset.