

## Results

In general, our group meets the goals we set before which is to find the shortest path from source airport to destination airport. We successfully generate the output PNG as the outcome of our code and calculate the shortest path's distance. In order to make that happen, we create seven main functions and several helper functions, starting from reading from dataset file to Dijkstra's algorithm implementation. We did encounter some difficulties, but we were able to solve it.

The first problem was the Makefile. None of us have the experience of writing a complete make file, and we did not know where to start other than the Makefile examples in the earlier MP and lab. We learnt how to implement the Makefile and remembered that each file needs to be linked to be able to make. We also didn't have any coding experience for 2 of the algorithms, during the process we combined the knowledge in the lectures and slides to help us learn the concept and utilize those in our codes.

The second thing we learnt was how to calculate the distance at any given two points on Earth. We had thought that the shortest path between two vertices would just be the direct edge connecting them if the edge exists, similar to how we calculate the shortest distance between two dots. However, after we did some calculation, we found out that Earth is not like the plots we draw in math class, and the line connecting the dots might not be the shortest one. So, after we did some research, we discovered that the shortest path between two points is the inferior arc of great circle.

With those discoveries, we were able to produce the code as what we originally expected. The three pictures included below are the result of one of our test runs. As we put down "Beijing Capital International Airport" for the source airport, and "Chicago O'Hare International Airport"

for the destination airport. By running shortest path and determine if there are route between the airports, we got the following output. The shortest path (distance wise) is for traveler first flying to “Guangzhou Baiyun International Airport”, and from there flying to the destination. In the graph we also marked the airport with a 5x5 pixel red pixels, and also marked the path following the change in longitude and latitude. The first graph shows the flight from Beijing to Guangzhou. And the second graph representing the route from Guangzhou to Chicago.

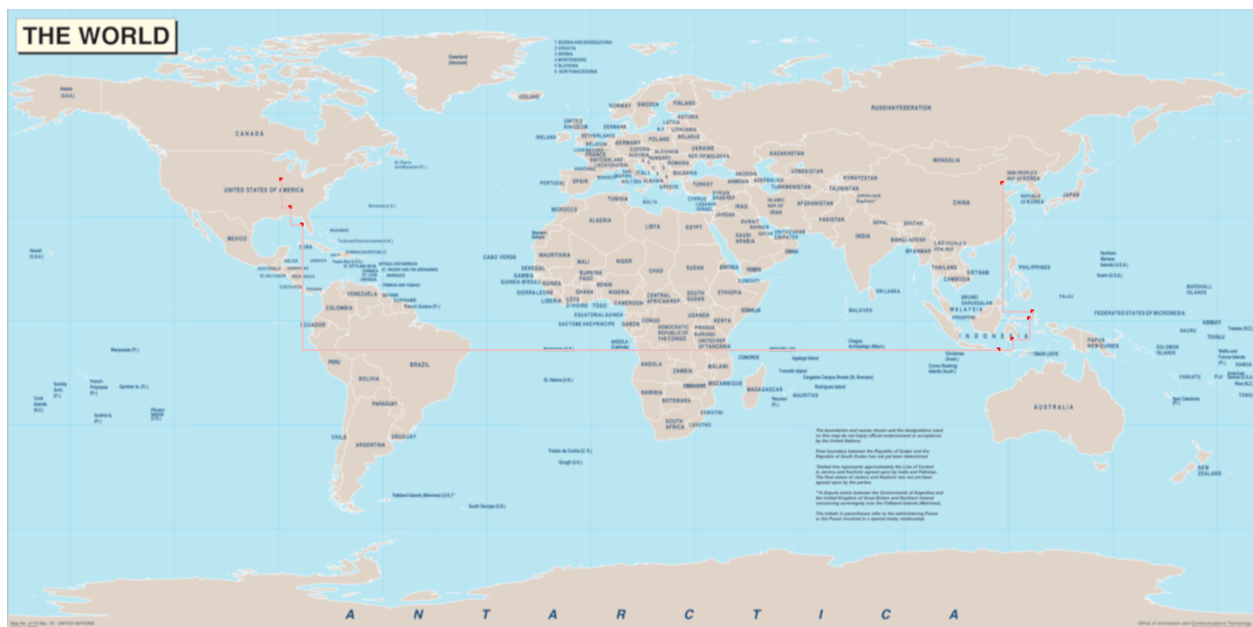


Figure 1source: Beijing Capital International Airport, destination: Chicago O'Hare International Airport



Figure 2 source: Beijing Capital International Airport, destination: Los Angeles International Airport



Figure 3 source: Beijing Capital International Airport, destination: Guangzhou Baiyun International Airport