Assignment 4

Due: 04/30/2023 on Canvas
(100 points)

Introduction

In this assignment, you will be designing and implementing algorithms to store and search graphs. World Airline (WA) flies to many destinations worldwide including: Moscow, Seoul, Tokyo, Hong Kong, and London. Complete detailed information regarding airline flight routes can be found from the link *flight.txt*. The flight.txt contains a "from city" and its destination cities that WA flights to.

In the public.zip, we are providing you with the following files:

```
public/
 city.name     <-input file for building the graph in a adjacency matrix
flight.txt    <-input file for building the graph in a adjacency matrix
minheap_pair.h   <-minheap implementation (each element is a pair of
distance and node ID)
 WA.cpp       <-implementation of graph and route search(only file you
need to modify)
```

In the WA.cpp file, task 1 (I am in city "A", can I fly to city "B" with less than x connections? Give me the route with the smallest number of connections or tell me there is no such a route) has been implemented (see the routeSearch_1 function). Please use this as reference to implement the following task.

Your task

Your task is to design and implement algorithms to answer the following question.

> 2. Give me the route with the smallest number of connections from city "A" to city "D" through city "B" and "C". (the order of "B" and "C" is not important). Or tell me there is no such a route.

Specifically, you need to complete the routeSearch_2 function:

```
253 //Task 2
254 void routeSearch_2(Graph graph, int city_A, int city_B, int city_C, int city_D) {
255
256 }
```

[hint: Let's assume that we want to find the route with the smallest number of connections from city "A" to city "C" through city "B". This question can be divided into two parts: 1. Find the route1 with the smallest number of connections from "A" to "B" (Similar to task 1). 2. Find the route2 with the smallest number of connections from "B"

to “C” (Similar to task 1). If route 1 and route 2 exist, then combine these two routes is our final output.]

Sample output:

```
bj0141@cell06-cse:~/5150/assn4$ g++ WA.cpp
bj0141@cell06-cse:~/5150/assn4$ ./a.out

The graph generated can be represented by the following adjacent matrix :
--------------------------------------------------------------------------------
```

……

```
Please choose the type of the questions:
1: From city 'A' to city 'B' with less than x connestions?
2: Route with the samllest number of connections from city 'A' to city 'D' through city 'B' and 'C'?
2
Please enter the city A: 1
Please enter the city D: 139
Please enter the city B: 2
Please enter the city C: 3
No such route.
```

```
bj0141@cell06-cse:~/5150/assn4$ ./a.out
```

……

```
Please choose the type of the questions:
1: From city 'A' to city 'B' with less than x connestions?
2: Route with the samllest number of connections from city 'A' to city 'D' through city 'B' and 'C'?
2
Please enter the city A: 1
Please enter the city D: 4
Please enter the city B: 2
Please enter the city C: 3
city1 to city88 to city79 to city2 to city85 to city3 to city84 to city108 to city4
Total connection: 8
```

What to turn in

1. At least 2 screenshots of your test running result.

2. All files that are needed to compile and run your code. It is mandatory that you include a README file, including compilation and running instructions.

Please compress these two parts in a zip file and upload this zip file on Canvas.