Task Description: https://github.com/bigyan313/airports-searching-in-C-.git

Individual Design Assignment
Name: Bigyan Adhikari (CS Student)
UTA ID: 1001398922
CSE-3310-002

Assignment Report

1. Problem Statement

Locating places on earth has been a really good feature of present world that enables airplanes, vehicles, people and other technological devices to navigate.
We want to build a program that is capable of finding all airports within a given radius of a given airport.
In order to locate close airports within given radius, we will need to have the distance between the given airport and other airports, but we might not have distance information of a particular airport with other airports all the time. On the other hand, we can fix this issue by evaluate distance between two places on earth by using their geological values. Every place on earth will have its longitude and latitude. If we are able to use this geological value, we can calculate the distance between any points by using math equation and list the airports that are close to a given airport.

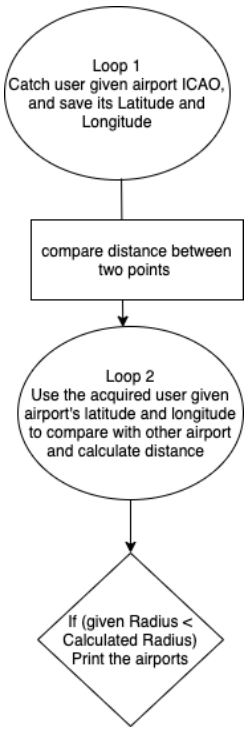
2. Schedule

Individual Assignment Phase	Est Time	Time Taken	Reason it took long or not long than the estimated time. Description
Thinking about the approach	5.0	5.0	On time
Writing distance function	120.0	60.0	Professor provided a reference link which has math equations for finding distance
Opening file and tokenizing elements	60.0	300.0	Thought easier but figured many constraints.
			Had to tokenize elements either by " " " or " , " comma in different cases
Using distance function and printing statements	30.0	60.0	stold conversion error occurred. took longer than expected
Fixing and Handling corrupt/misplaced tokens	60.0	10.0	I thought it would take longer but after using exception throw, it was easier to handle this error
Comments	30.0	30.0	On time
Make-file	10.0	10.0	On time
Total Time Taken in Minutes	275.0	435.0	160 mins longer than expected
Total Time Taken in Hours	4.6	7.3	2.67 hrs. longer than estimated

3. Requirement Analysis

REQ ID	F/NF	DESCRIPTION	CLASS/METHOD
100	F	Program must use C or C++ standard library	int main()
101	F	Program must use the values from given data file airports.dat	int main()
102	F	Program shall take user input as four ICAO letters and radius from command line tool	int main()
103	F	Program will execute until user enters negative radius	int main()
104	F	Program shall tokenize the lines in data file in order to acquire corresponding values	stringstream limitLine(fileLine);
105	F	All the tokenized strings should be stored for future reference	getline(limitLine, name, "");
106	F	Some tokenized strings need to be converted into integers or double value	stold(strings);
107	F	Error tokens should be handled if they occur	int main()
108	F	Program will have functions to convert geological coordinates into distance	long double distance(X4 long double)
109	F	Program can have some string tools like erasing begin and end characters in order to remove some characters	string.erase():
110	F	Program needs two loops to traverse entire lines	while (! EOF)
111	F	One while loop will be used to catch given airport position	int main()
112	F	Another loop will be used to compare distance between given airport and other airports	int main()
113	F	Program shall return all airports that lie in a given radius	int main(), cout<<
114	F	Program shall have case handling if it cannot convert strings into integers	try{this} catch(exception}
115	F	Program shall close all open file after using it	int main(), file.close();
116	NF	Program shall be delivered in a tarball with all source codes	-
117		Program will inform users how many conversions error occurred	-
118	NF	Program must be readable	-
119	NF	Program code shall have comments	-

4. Design



Class Diagram

+ id, + name, + city, + country, + iata, + icao, + Latitude, + Longtitude, + altitude, + time, + dst, + tz, + type, + source; + namec, + cityc, + countryc,

+ iatac, + icaoc; + userAirportLat + userAirportLong + radiusArea + radius + userICAO
+ long double convertToRadians(degree: long double) + long double distance(userAirportLat: long double, userAirportLong: long double, dataAirportlat: long double, dataAirportlong:long double)

5. Alternatives

Approach 1	Approach 2
Evaluating distance using 2D vector Design a 2D vector that stores all the vectors that has airport data Storing the given airport values in some data structure. Then we can traverse through the 2D vector, compare distance between the airports and print all the airport that lies in the given radius.	By using complete OOP paradigm. Would lead to create multiple objects. Multiple objects are hard to abstract And would take more time to fix error if we used OOP. Would take me too much time to think about OOP principles rather than solving deep problems of the progeam.

I realized that all the lines couldn't be tokenized in a similar way with other lines. This might create error strings and puts the values in vector in an incorrect order. While accessing that vector, it can cause error while performing string to integer conversions.
So, I used two loops to solve this without making 2D vector or objects. Instead, I used two loop to solve this.

6. Constraints

I. All the lines in the data file doesn't separate values in fixed order

Case 1: Lines 4295 and 4296 in airport.dat

Line 4295 has 14 "," comma

Line 4296 has 13 "," comma

If we use " , " as key to generate tokens, it will place tokens in different order.

I found this constraint by calculating total number of "," and dividing it with total number of lines. When I divide the total number of "," lines by total lines, the result was a decimal integer.

Problem: If I used " , " to separate values I would miss full name of the airport and if I used quotations ' " ' I wouldn't be able to get values for latitude and longitude.

My approach to solve this:

Firstly, I tokenized half of the lines using quotations ' " ' and rest of the lines by comma " , " . I tried to insert maximum tokens into correct values but everything in the universe is not perfect and easy. This constraint would affect converting latitude and longitude and during integer conversion, there would have been problem. I implemented exception throw clause in this program to escape invalid string to integer conversion error as below:

```
//We will look the entire file data
while (!inFile.eof())
{
    getline(inFile, fileLine);              //Tokenizing entire file line
    stringstream limitLine(fileLine);       //stringstream operates in string, will help to tokenize strings into streams
    getline(limitLine, id, '"');            //Tokenizing airport id
    getline(limitLine, name, '"');          //Tokenizing airport name
    getline(limitLine, namec, '"');         //Tokenizing comma " , " after airport name
    getline(limitLine, city, ',');          //Tokenizing airport city
    getline(limitLine, country, ',');       //Tokenizing airport country
    getline(limitLine, iata, ',');          //Tokenizing airport IATA
    getline(limitLine, icao, ',');          //Tokenizing airport ICAO
  //  cout<<icao<<endl;
    // removing quotation " " from acquired ICAO
    //It will transform "KDFW" to KDFW so it will be easir to compare with user input ICAO
    icao.erase(remove(icao.begin(),icao.end(),'\"'),icao.end());

    getline(limitLine, Latitude, ',');      //Tokenizing airport latitude
```

Fig: How values are tokenized. Safely catching full name of the airport.

```
//It will transform "KDFW" to KDFW so it will be easir to compare with user input ICAO
icaonxt.erase(remove(icaonxt.begin(),icaonxt.end(),'\"'),icaonxt.end());
getline(limitLine, Latitudenxt, ','); //Tokenizing airport latitude

//After we catch ICAO from data file we will store its latutude and longitude
try{
    dataAirportlat = stold(Latitudenxt);
}
catch(exception &err)
{
    continue;  // Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
}

getline(limitLine, Longtitudenxt, ',');
try{
    dataAirportlong = stold(Longtitudenxt);
    }
catch(exception &err)
{
     continue; //Couldnt execute stold(Longtitudenxt)? Caught error? Good. Continue though!
}

//Findind the distance between two points
long double radiusArea = distance(userAirportLat, userAirportLong,dataAirportlat, dataAirportlong);
```

Fig. How exception throw is implemented

If error strings arrive for latitude and longitude tokens, escape the stold execution.

II. Null values \N

```
315,"Weelde Air Base","Weelde","Belgium",\N,"EBWE",51.394798278808594,4.960189
316,"Zoersel (Oostmalle) Airfield","Zoersel","Belgium","OBL","EBZR",51.264702,
317,"Flugplatz Bautzen","Bautzen","Germany",\N,"EDAB",51.193611,14.519722,568,
318,"Altenburg-Nobitz Airport","Altenburg","Germany","AOC","EDAC",50.981945,12
319,"Dessau Airfield","Dessau","Germany",\N,"EDAD",51.831694,12.190962,187,1,"
320,"Eisenhüttenstadt Airfield","Eisenhuettenstadt","Germany",\N,"EDAE",52.195
322,"Großenhain Airport","Suhl","Germany",\N,"EDAK",51.30805587768555,13.55555
323,"Merseburg Airport","Muehlhausen","Germany",\N,"EDAM",51.3630556,11.940833
324,"Halle-Oppin Airport","Halle","Germany",\N,"EDAQ",51.552223,12.053889,348,
325,"Riesa-Göhlis Airport","Riesa","Germany","IES","EDAU",51.2936096191,13.356
```

This won't affect the output because above tokenizing procedure and exception throw will handle this.

III. Some airports name have “ , “ comma. If comma is used to tokenize line, there’s chance of missing airports full name

```
ENEV Harstad/Narvik Airport, Evenes 4665.68
ENRY Moss Airport, Rygge 4856.45
ENSB Svalbard Airport, Longyear 4295.12
ENTC Tromsø Airport, 4664.61
ENTO Sandefjord Airport, Torp 4847.63
WAPP Pattimura Airport, Ambon 8891.53
YMPC RAAF Williams, Point Cook Base 8997.28
KPBF Pine Bluff Regional Airport, Grider Field 306.552
KHUF Terre Haute Regional Airport, Hulman Field 705.588
ENOV Ørsta-Volda Airport, Hovden 4622.92
ENFB Oslo, Fornebu Airport 4832.67
ENRA Mo i Rana Airport, Røssvoll 4693.12
ENRM Rørvik Airport, Ryum 4671.26
ENSS Vardø Airport, Svartnes 4852.57
YLVT RAAF Williams, Laverton Base 8996.5
HSFA Paloich Airport, Heliport 7956.16
```

The tokenizing procedure shown in source code above will solve this issue.

IV. Chance of printing the user given airport
Case: For airport KDFW, its printing its own distance.

```
Enter a ICAO and the Radius:
KDFW 50.0


KDAL Dallas Love Field 11.3301
KDFW Dallas Fort Worth International Airport 0
```

Solved this issue using simple if statement.

```
            if(radiusArea<radius){
                if (userICAO.compare(icaonxt)!=0){  //If user input ICAO comes, dont print that airport
                cout<<icaonxt<<" "<<namenxt<<" "<<radiusArea<<endl;
                }
            }
        }
        inFilenxt.close();
    cout<<"\n"<<endl;
```

After solved:

```
Enter a ICAO and the Radius:
KDFW 50.0


KDAL Dallas Love Field 11.3301
KFTW Fort Worth Meacham International Airport 19.5512
KNFW NAS Fort Worth JRB/Carswell Field 25.0121
KADS Addison Airport 12.691
KGKY Arlington Municipal Airport 16.4095
KTKI Collin County Regional At Mc Kinney Airport 32.36
KRBD Dallas Executive Airport 17.8705
KAFW Fort Worth Alliance Airport 17.4367
KHQZ Mesquite Metro Airport 31.2156
KDTO Denton Municipal Airport 22.935


Enter a ICAO and the Radius:
```

7. Source code
   Source Code is in tarball

8. Analysis
   Test Case 1: Program gives ICAO, full name of Airport and distance from the given airport.

```
ENEV "Harstad/Narvik Airport, Evenes" 4665.68
ENRY "Moss Airport, Rygge" 4856.45
ENSB "Svalbard Airport, Longyear" 4295.12
ENTC "Tromsø Airport," 4664.61
ENTO "Sandefjord Airport, Torp" 4847.63
WAPP "Pattimura Airport, Ambon" 8891.53
YMPC "RAAF Williams, Point Cook Base" 8997.28
KPBF "Pine Bluff Regional Airport, Grider Field" 306.552
KHUF "Terre Haute Regional Airport, Hulman Field" 705.588
ENOV "Ørsta-Volda Airport, Hovden" 4622.92
ENFB "Oslo, Fornebu Airport" 4832.67
ENRA "Mo i Rana Airport, Røssvoll" 4693.12
ENRM "Rørvik Airport, Ryum" 4671.26
ENSS "Vardø Airport, Svartnes" 4852.57
YLVT "RAAF Williams, Laverton Base" 8996.5
HSFA "Paloich Airport, Heliport" 7956.16

All Output                                                16
```

   Test Case 2: Incorrect latitude or longitude tokens found and were skipped to avoid stold error. 12 possible error avoided.

```cpp
//After we catch ICAO from data file we will store its latutude and longitude
try{
    dataAirportlat = stold(Latitudenxt);
}
catch(exception &err)
{
    cout<<"Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!"<<endl;
    continue;  // Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
}

getline(limitLine, Longtitudenxt, ',');
try{
    dataAirportlong = stold(Longtitudenxt);
    }
catch(exception &err)
{
    cout<<"Couldnt execute stold(Longtitudenxt)? Caught error? Good. Continue though!"<<endl;
     continue; //Couldnt execute stold(Longtitudenxt)? Caught error? Good. Continue though!
}
```

```
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
Couldnt execute stold(Latitudenxt)? Caught error? Good. Continue though!
```

Poker Hand Determining Code: https://github.com/bigyan313/pokerHandRank.git