CS205 C/ C++ Programming - Lab Assignment1

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Part 1- Analysis

The problem is to ask user to inut two cities' name and their latitude and longitude, then calculate the flying distance between the two cities. I solve the problem by two steps.

step I : use cin to get what users input.

step II : use `mathematical` equations to calculate the distance:

phi = 90 - latitude(0 <= phi <= 180)

theta = longitude(-180 <= theta <= 180)

c = sin(phi1) * sin(phi2) * cos(theta1-theta2) +cos(phi1) * cos(phi2)

d = R*arccos(c)(R=6371)

I include <math.h> to calculate sin, cos and acos.

And define macro to transfer degree to radias.

I also use some ways to do error check.

Part 2- Code

My develop environment is:

```
C:\Users\联想>gcc -v
Using built-in specs.
COLLECT_GCC=gcc
COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-pc-cygwin/7.4.0/lto-wrapper.exe
Target: x86_64-pc-cygwin
Configured with: /cygdrive/i/szsz/tmpp/gcc/gcc-7.4.0-1.x86_64/src/gcc-7.4.0/configure --srcdir=/cygdrive/i/szsz/tmpp/gcc
/gcc-7.4.0-1.x86_64/src/gcc-7.4.0 --prefix=/usr --exec-prefix=/usr --localstatedir=/var --sysconfdir=/etc --docdir=/usr/
share/doc/gcc --htmldir=/usr/share/doc/gcc/html -C --build=x86_64-pc-cygwin --host=x86_64-pc-cygwin --target=x86_64-pc-c
ygwin --without-libiconv-prefix --without-libintl-prefix --libexecdir=/usr/lib --enable-shared --enable-shared-libgcc --
enable-static --enable-version-specific-runtime-libs --enable-bootstrap --enable-__cxa_atexit --with-dwarf2 --with-tune=
generic --enable-languages=ada,c,c++,fortran,lto,objc,obj-c++ --enable-graphite --enable-threads=posix --enable-libatomi
c --enable-libcilkrts --enable-libgomp --enable-libitm --enable-libquadmath --enable-libquadmath-support --disable-libss
p --enable-libada --disable-symvers --with-gnu-ld --with-gnu-as --with-cloog-include=/usr/include/cloog-isl --without-li
biconv-prefix --without-libintl-prefix --with-system-zlib --enable-linker-build-id --with-default-libstdcxx-abi=gcc4-com
patible --enable-libstdcxx-filesystem-ts
Thread model: posix
gcc version 7.4.0 (GCC)
```

```
#include<iostream>
#include<math.h>
#define RAD_TO_DEGREE(x) ((x)*3.14159/180.0)
using namespace std;



struct City
{
   string name;
   double latitude;
   double longitude;
```

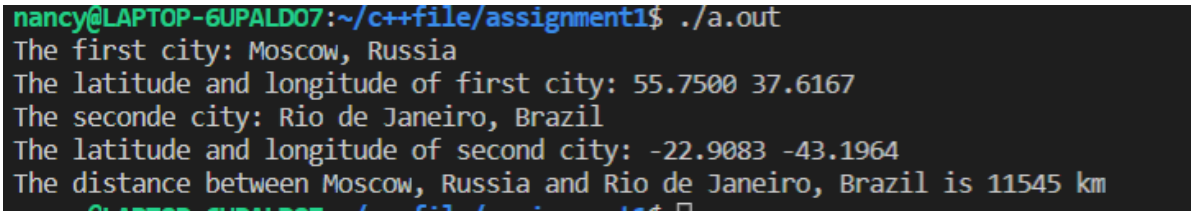
```
};

double Distance(City city1, City city2)
{
    double phi1=RAD_TO_DEGREE(90-city1.latitude);
    double phi2=RAD_TO_DEGREE(90-city2.latitude);
    double theta1=RAD_TO_DEGREE(city1.longitude);
    double theta2=RAD_TO_DEGREE(city2.longitude);
    double c=sin(phi1)*sin(phi2)*cos(theta1-theta2)+cos(phi1)*cos(phi2);
    return 6371*acos(c);
}


int main()
{
    City  city1;
    City  city2;


//first city
    cout<<"The first city: ";
    getline(cin,city1.name);
    for (int i = 0; i < city1.name.length(); i++)
    {
        if (city1.name[i]!=' '&&city1.name[i]!=','&&!isalpha(city1.name[i]))
        {
            cout<<"There are some incorrect formats.";
            return 0;
        }
    }

    cout<<"The latitude and longitude of first city: ";
    cin>>city1.latitude;
    if(cin.good()==0){
        cout<<"There are some incorrect formats";
        return 0;
    }
    else if (city1.latitude>90||city1.latitude<-90)
    {
       cout<<"invaild latitude!";
       return 0;
    }

    cin>>city1.longitude;
    if(cin.good()==0){
        cout<<"There are some incorrect formats";
        return 0;
    }
    else if (city1.longitude>180||city1.longitude<-180)
    {
       cout<<"invaild longitude!";
       return 0;
    }

//second city
    cout<<"The seconde city: ";
    cin.get();
```

```
    getline(cin,city2.name);
    for (int i = 0; i < city2.name.length(); i++)
    {
        if (city2.name[i]!=' '&&city2.name[i]!=','&&!isalpha(city2.name[i]))
        {
            cout<<"There are some incorrect format.";
            return 0;
        }
    }

    cout<<"The latitude and longitude of second city: ";
    cin>>city2.latitude;
    if(cin.good()==0){
        cout<<"There are some incorrect formats";
        return 0;
    }
    else if (city2.latitude>90||city2.latitude<-90)
    {
       cout<<"invaild latitude!";
       return 0;
    }

    cin>>city2.longitude;
    if(cin.good()==0){
        cout<<"There are some incorrect formats";
        return 0;
    }
    else if (city2.longitude>180||city2.longitude<-180)
    {
       cout<<"invaild longitude!";
       return 0;
    }

    cout<<"The distance between "<<city1.name<<" and "<<city2.name<<" is "
<<Distance(city1,city2)<<" km"<<endl;



}
```

Part 3- Result & Verification

Test case #1:

Test case #2:



Test case for error checking:

1.if we include number or invalid characters in city name:

```
The first city: shenz1
There are some incorrect formats.nancy@LAPTOP-6UPALDO7:~/c++file/assignment1$ ./a.out
The first city: shz!
There are some incorrect formats.nancy@LAPTOP-6UPALDO7:~/c++file/assignment1$
```

2.if we input character when it asks us to input latitude and longitude:

```
nancy@LAPTOP-6UPALDO7:~/c++file/assignment1$ ./a.out
The first city: shenzhen
The latitude and longitude of first city: c 12
There are some incorrect formatsnancy@LAPTOP-6UPALDO7:~/c-
```

3.if the range of latitude and longitude is invalid:

```
The first city: shenzhen
The latitude and longitude of first city: 190 22.5
invaild latitude!nancy@LAPTOP-6UPALDO7:~/c++file/assignment1$
```

Part 4 - Difficulties & Solutions

In the beginning, I don't know how to judge the input is a number or not, then I looked it on the Internet and used cin.good() functions.