CS205 C/ C++ Programming - Lab Assignment 1

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Part 1 - Analysis

The problem is to calculate the distance between two cities. We have to read the name, latitude and longitude of two's cities. Then calculate the distance and output. Because the angle, which is described in the statement, is measured with degree, we need to first convert degree to radian.

$$phi = 90 - Latitude$$
$$theta = Longitude$$
$$c = \sin(phi_1) * \sin(phi_2) * \cos(theta_1 - theta_2) + \cos(phi_1) * \cos(phi_2)$$

Part 2 - Code

```cpp
#include <cmath>
#include <cstdio>
#include <iostream>
#include <string>
using namespace std;

const int maxn = 1e3 + 10;
const double PI = acos(-1);

char s1[maxn];
char s2[maxn];

double phi1, phi2;
double theta1, theta2;
string buffer;

double get_arc(double x) { return x * PI / 180; }

int main() {
    printf("Please input the first city: <city name> <latitude> <longitude>\n");
    cin.getline(s1, maxn);
    scanf("%lf%lf", &phi1, &theta1);
    getchar();
    printf("Please input the second city: <city name> <latitude> <longitude>\n");
    cin.getline(s2, maxn);
    scanf("%lf%lf", &phi2, &theta2);
```

```
27
28      phi1 = 90 - phi1, phi2 = 90 - phi2;
29      phi1 = get_arc(phi1);
30      phi2 = get_arc(phi2);
31      theta1 = get_arc(theta1);
32      theta2 = get_arc(theta2);
33
34      double c = sin(phi1) * sin(phi2) * cos(theta1 - theta2) + cos(phi1) *
    cos(phi2);
35      double d = 6371 * acos(c);
36
37      printf("The distance between %s and %s is %.2f km", s1, s2, d);
38      return 0;
39 }
40
```

Part 3 - Result & Verification

The verification is combined with the result queried in the website.

Test case #1:

```
1  Input: Shenzhen
2         22.55 114.1
3         Beijing
4         39.9139 116.3917
5  Output: The distance between Shenzhen and Beijing is 1942.82 km
```

```
→  Assignment1 git:(master) ✗ ./a.out
Please input the first city: <city name> <latitude> <longitude>
Shenzhen
22.55 114.1
Please input the second city: <city name> <latitude> <longitude>
Beijing
39.9139 116.3917
The distance between Shenzhen and Beijing is 1942.84 km
```

Part 4 - Difficulties & Solutions

1. The difficulty is to convert degree to radian.

   We can multiply degree with pi/180 to get radian.

2. The second problem is how to read a line from input.

   We can use `cin.getline()` to read a line.