Summer Coding Assignments

Assignment 2: Classes and Strings in C++

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This assignment is designed to familiarize you with `classes` and `strings` in C++. In C++, string is a data type, just like int, therefore handling is much easier than in C. You just need to use $\#include < string >$.

Just do `string s = "hello";` and that's it. No messing around with NULL at the end, memory allocation, char pointer, nothing.

Classes are an extension of `structs` that you must have studied in C. If you remember coding linked lists and trees in your PDS course (or even if you don't), you would remember that you needed to use structs. Remember that structs had members and looked like this:

```
struct Complex {
  int re;
  int im;
};  //Don't forget the semicolon at the end.
```

In C++, we will use classes to implement those data structures. There is one major difference between `structs` and `classes` from coding point of view:

1. In a `struct`, you could access the members as shown below. In a class, you have to declare everything public, otherwise you will get an error if you try to do `c1.im = 5;`.

   ```
   int main() {
     struct Complex c1;
     c1.im = 5;  //You can directly access and assign value to members
   }
   ```

Same struct as a class. In class, you have to use `public:` keyword at the beginning to ensure you can access everything from outside.

```
class Complex {
 public:  //This line is extremely important
   int re;
   int im;
};   //Don't forget the semicolon at the end.
```

Resource on strings & classes:

- This webpage will teach you how to handle strings: `https://www.cprogramming.com/tutorial/string.html`.
- Classes(I) and Classes(II) from: `http://www.cplusplus.com/doc/tutorial/`. This will give you an introduction.
- Chapter 8 from this website will teach you all you need to know about classes in C++. `http://www.learncpp.com/`

1 Problem Statement

You will be given two complex numbers:

$$a + bj, c + dj \tag{1}$$

Your task is to find the sum and product of these complex numbers and write the output to the file. You are expected to make a class `Complex` which will have two members: int `re`, and `int im` for storing real and imaginary parts of the complex number. Don't forget to make them public.

You are expected to write four functions:

- Complex sum(Complex a, Complex b) : Returns the sum of a and b
- Complex product(Complex a, Complex b) : Returns the product of a and b
- string convertToString(Complex a) : Returns a string of the form "x+iy" when given an object "a" of Complex class.
- Complex convertToComplex(string s) : Takes a string of the form a+bj and returns a Complex number.

Save your C++ program as *FirstName_a2.cpp*

Input

The input will be read from a file called **input2**. The first line of the input file gives the number of test cases, T.

T test cases follow. Each test case consists of two complex numbers a+bj,c+dj separated by a comma.

Output

Write your output to a file and name it **output2**.

For each test case, output sum and product separated by a comma. Thus, your output file must contain a total of T lines, where T is the number of test cases.

Limits

In the input, both the real and imaginary parts will be positive. However, in the output, some of them can become negative.

Sample

```
input2
--------
3
1+1j,2+2j
3+5j,5+1j
0+4j,4+0j
output2
---------
3+3j,0+4j
8+6j,10+28j
4+4j,0+16j
```

2 Notes (Optional Reading)

C++ is much easier than C. We are going to use the website `http://www.learncpp.com/` and `https://www.tutorialspoint.com/cplusplus/index.htm` for learning C++. You only need to read the following if you are not familiar with C++. Otherwise, you can just go ahead with the assignment.

2.1 Opening File

```
#include <fstream>
#include <iostream>
#include <string>
using namespace std;

//Need to include the above statement in ALL C++ programs

int main() {
 fstream fin;
 fin.open("input1", ios::in); //Open file for reading
 fstream fout;
 fout.open("output1", ios::out); //Open file for writing
 cout<<"Both files opened"<<endl; //Print message to screen
}
```

2.2 How to read input in the given format?

- Read each line of the input file into a string s using the `getline` function of C++.

```
#include <fstream>
#include <iostream>
#include <string>
using namespace std;

int main() {
  fstream fin("input2", ios::in);
  int i, T; //for counting testcases
  fin>>T;
  for(i=0;i<T;i++) {
      string s;
      getline(fin, s);
      //do other things
  }
}
```

- Find the position of comma in this string s. Get two substrings s1 and s2.
- Use the convertToComplex function you wrote to get complex numbers from strings.
- In C++, you have some functions like `atoi, stoi` etc. which can convert string to integer.