

# Programming Design, Spring 2013

## Homework 02

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To submit your work, please e-mail TWO files to our TAs at r01725007(AT)ntu.edu.tw:

1. A PDF file (a .pdf file) for Problems 1 to 3.
2. Your source file (the .cpp file) for Problem 4.

Name your files by combining your student ID, an underline, and then “hw02” in order. For example, if I took this course with my undergraduate ID, my files should be “B90705023\_hw02.pdf” and “B90705023\_hw02.cpp”. Capitalize the first letter of your student ID. NO hard copy and NO late submission. The due time of this homework is 1:00pm, March 4, 2013.

### Problem 1

(10 points) Nowadays one of the most efficient way of learning a programming language is to utilize online resources. For example, suppose I want to calculate  $(6.5)^{1.23}$ , I may wonder whether there is any way of doing so in C++. All I need to do is to type “C++ power” in a search engine and do some search. In this homework, you will use the information contained in

<http://en.cppreference.com/w/cpp/numeric/math/pow>

to answer this problem. By reading this web page, I realize that there is a C++ function `pow()`, defined in the header file `<cmath>`, that provides the functionality of power. By reading the web pages, I know how to use the function to calculate  $(6.5)^{1.23}$  in C++: Just write `pow(6.5, 1.23)`.

However, we may find that there are many different `pow()` functions, each with different parameter types. In particular, two of the definitions are `double pow(double base, double exp)` and `double pow(double base, int iexp)`. You noticed that the types of the second parameter of the two `pow()` functions are different. Similar to the concept “operator overloading” introduced in class, by doing “function overloading”, C++ gives a function different implementations according to different parameter types.

Now, intuitively explain why people want to have two such different implementations. In particular, why don't we simply rely on `double pow(double base, double exp)` as a `double` variable is more precise and has a larger range than an `int` variable?

### Problem 2

(10 points; 2.5 each) For each of the following statements, indicate the sequence of executing all operations. For example, for the statement

```
cout << 3 + 8 * 5;
```

the answer should be “`8 * 5` goes first, and then `3 + 40`, and finally `cout << 43`.”

- (a) `cout << (3 + 8) * 5;`
- (b) `cout << "I like to " << "write C++ programs";`
- (c) `a = -b * c++;`
- (d) `a = b / ++c - 5 % 2;`

### Problem 3

(15 points; 5 points each) Consider the following program

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

int main()
{
    int integer1 = 0;
    int integer2 = 0;

    cin >> integer1;
    cin >> integer2;

    cout << integer1 % integer2;

    return 0;
}
```

Now, answer the following questions.

- (a) What does the programmer want to do?
- (b) In doing computer programming, there are two kinds of errors: syntax errors and logic errors. When a programmer makes a syntax error, he fails to follow the C++ grammar. The compilation will not be successful. When he makes a logic error, however, it is the logic of the program, not the grammar, that is wrong. While the compilation will be successful, the result of executing the program may not be expected by the programmer. In this program, there is at least one syntax or logic error. Please point it or them out.
- (c) Propose a way of fixing the error(s) you find. It is fine if you do not know how to write codes to implement your proposal. All you need to do is to conceptually explain how to fix the error(s) in words.

### Problem 4

(65 points) Please write a C++ program according to the following instructions.

#### What should your program do

Your friend is running a factory which produces plates in the shape of right triangles and circles with a particular kind of material. The triangular plates' heights are all 2 cm but their lengths of legs and hypotenuses may differ. Similarly, the circular plates' heights are all 3 cm but their radii may differ. Every time when a customer places an order, the customer will specify the lengths of the two legs and the radius (in cm). Your friend wants to have a program that will calculate (1) the weight of the triangular plate, (2) the weight of the circular plate and (2) the length of the hypotenuses according to the lengths of the two legs. The density of the material is 10 g/cm<sup>3</sup>.

Please help your friend by writing a C++ program for her. The program should allow the user to input three values as the lengths of the two legs in the right triangle and the radius in a circle. Thees values may be integers or fractional numbers. However, you may assume that the user will only enter positive numeric values. Then the program should calculate the desired quantities and then output them.<sup>1</sup> Your outputs should be as precise as possible.

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<sup>1</sup>Suppose the two legs are  $x$  and  $y$ , then the hypotenuse equals  $\sqrt{x^2 + y^2}$ . The knowledge obtained by doing Problem 1 in this homework may help.

### What should be in your source file

Your .cpp source file should contain C++ codes that will complete the above task. Moreover, you should write relevant comments for your codes. It is also suggested that you give clear enough prompts to instruct the user for entering the inputs.

### Grading criteria

- 60% of your grades for this program will be based on the correctness of your output. In other words, the TA will open your submitted .cpp file, press “compile and run”, test your program, and check the output on screen. If, for example, there is a compiling error, then you get 0 out of 60.
- 30% of your grades for this program will be based on how you write your program, including the logic and format. For homework 2, we will particularly focus on how you organize your variables, input and output statements, and calculations. How you select the types of your variables also matters (Hint: Is there a way to use a `const` variable?) The format of your source codes is also important. Please carefully follow the instructions provided in the lecture notes or the textbook.
- 10% of your grades for this program will be based on whether you name your submitted files correctly. If they perfectly follows the instruction given in this homework, you get 10; otherwise, you get 0.