

Programming Design, Spring 2016

Homework 1

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To submit your work, please upload a PDF file for Problems 1 and 2 and a CPP file for Problem 3 to PDOGS at <http://pdogs.ntu.im/judge/>. Each student must submit her/his individual work. No hard copy. No late submission. The due time of this homework is 2:00am, February 29, 2016. Please answer in either English or Chinese.

Before you start, please read Sections 1.7–1.9, 1.14, 2.1–2.8, 3.1–3.5, and 3.7–3.9 in the textbook.¹

The TA who generated the testing data and will grade this homework is Parker Chiang.

Problem 1

(20 points) Eren is trying to write a C++ program that can help him manage the grades earned by Mikasa, Eren, and Armin in an examination. To use the program, first the instructor should enter three grades. To prevent the instructor from mistakenly entering negative numbers, Armin suggests Eren to use `while` loops so that the program continues only after a positive grade is entered. Armin gives the following example program:

```
int a;
cin >> a;
while(a < 0)
    cin >> a;
```

The instructor needs Eren's program to determine whether the sum of the three grades is 300 and print out "Wonderful!" if it is the case. Eren's program is the following:

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

int main()
{
    int a,b,c;
    cin>>a;
    while(a<0)
        cin>>a;
    cin>>b;
    while(a<0)
        cin>>b;
    cin>>c;
    while(c<0)
        cin>>c;
    int d=a+b+c;
    if(d=300)
        cout<<"Wonderful!\n";
    return 0;
}
```

The program can be compiled and executed, so there is no syntax error. However, there seem to be some logic errors.

- (10 points) Point out all the logic errors, explain why, and indicate how to fix them. To explain why it is an error, please provide a test case (i.e., a sequence of inputs) to show that the program will give a wrong answer.

¹The textbook is *C++ How to Program: Late Objects Version* by Deitel and Deitel, seventh edition.

- (b) (5 points) Add proper white spaces, empty lines, indentation to format the program in a nice way. Please also rename variables and initialize them.
- (c) (5 points) Add proper prompts and comments to enhance the user interface.

Problem 2

(20 points)

Please write a C++ program to print out

```
Hi everyone,
```

```
This is Mikasa's first program,  
stored at C:\Users\User\Documents.
```

```
Best,  
Mikasa
```

Make sure that all the punctuation marks, line breaks, and special characters are put exactly in the same way as the above. Beside making your program correct, please also format your program in a good way.

Problem 3

(60 points) Given two nonzero integers b and c within $[-1000, 1000]$, we are interested to know their sum, difference, product, whether one can divide the other, and the maximum number among their sum, difference, and product. More precisely, you will be given three integers $a \in \{1, 2, 3, 4, 5\}$, b , and c . You then need to print out one number according to the following rule: (1) If $a = 1$, print out $b + c$; (2) if $a = 2$, print out $|b - c|$ (the absolute value of $b - c$); (3) if $a = 3$, print out bc ; (4) if $a = 4$, print out 1 if either b divides c or c divides b and 0 otherwise; (5) if $a = 5$, print out $\max\{b + c, |b - c|, bc\}$. Below are some examples:

- Input: $a = 1, b = 10, c = -5$; output: 5.
- Input: $a = 2, b = 4, c = 84$; output: 80.
- Input: $a = 3, b = 1, c = -5$; output: -5.
- Input: $a = 4, b = 11, c = 242$; output: 1.
- Input: $a = 4, b = 11, c = 243$; output: 0.
- Input: $a = 5, b = 3, c = -2$; output: 5.

Input/output formats

There are 35 input files. In each file, there are 3 nonzero integers a, b , and c and then a newline character. Two consecutive integers are separated by one white space. The value of a can only be 1, 2, 3, 4, or 5. The values of b and c are nonzero integers between -1000 and 1000 . Given these three values, your program should print out one integer and then a newline character.

To read inputs from the files on PDOGS, simply use `cin` as if a user will enter those input values according to the above rules. Then simply output your results using `cout` as if you are required to print out values on your screen according to the above rules. PDOGS will execute your program for 35 times, each time with a different input file. The 35 sets of outputs will be graded separately.

What should be in your source file

Your .cpp source file should contain C++ codes that will both read testing data and complete the above task. For this problem, you are NOT allowed to use techniques not covered in lectures. Finally, you should write relevant comments for your codes.

Grading criteria

- 70% of your grades for this program will be based on the correctness of your output. PDOGS will compile your program, feed testing data into your program, and check the correctness of your outputs. Each fully correct set of outputs gives you 2 points.
- 30% of your grades for this program will be based on how you write your program, including the logic and format. Please try to write a robust, efficient, and easy-to-read program.