Programming Design, Spring 2014
Homework 9

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Submission. To submit your work, please upload the following file(s) to the online grading system at http://lckung.im.ntu.edu.tw/PD/.

1. Your .cpp file(s) for Problems 1 and 2. You are allowed to submit two different files for the two different problems. Therefore, you need to do two submissions. Of course, you may write just one program and submit it twice.

Each student must submit her/his individual work. No hard copy. No late submission. The due time of this homework is ***8:00am, May 12, 2013***. Please answer in either English or Chinese.

Problem 0

(0 point) Please read Sections XXX of the textbook.[1] In any case, I strongly suggest you to read the textbook thoroughly before you start to do this homework.

Problem 1

(100 points) Let's forget apples for a while and consider a simply mathematics problem: multiplying polynomials. Consider two polynomials $p_1(x) = x^2 + 3x + 2$ and $p_2(x) = x - 4$, their product is $p_1(x)p_2(x) = x^3 - x^2 - 10x - 8$. In this homework, you will write a program that can find the product of multiple polynomials. Those polynomials will be contained in multiple files. You will need to use file I/O techniques to find them. Moreover, they will be provided in a unstructured format. You are suggested to use C++ strings to do the task.

Input/output formats

Many polynomials will be stored in many plain text files. In each file, each polynomial occupies a line. A polynomial has only one variable which is a single English letter (case-sensitive). For example, a polynomial with y as the variable may be $y^3 + 2y - 3$. This polynomial is stored as

```
y^3 + 2y - 3
```

in our files. Please note that there is a white space between two neighboring operand (like `y^3`) and operator (like `+`). For each term, there is no white space inside. Therefore, y^3 must be stored as `y^3` rather than `y ^ 3`, `y^ 3`, or `y ^3`. Similarly, $2y$ must be stored as `2y` rather than `2 y`.

The main input file contains two lines of data. In the first line, multiple strings, separated with white spaces, are provided as the main file names of files containing polynomials. All the extension file names are "txt". You may read the first line to see what data files to open (in the same folder) for reading polynomials. The second line in the main input file contains a sequence of variables separated with white spaces. Your program should output the products of polynomials for these variables in the given order, each in a single line.

Consider the following example with two polynomial files and three variables:

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

(main input file)	("file1.txt")	("anotherFile.txt")

`file1 anotherFile`
`x z y`
	`x^2 + x + 1`
	`y + 2`
	`z`
	`x^3 - x`
		`x`
		`z^2 - z`

PDOGS will first feed your program with the data contained in the main input file (so you may use `cin` to read them). According to the first line, you know you should open "file1.txt" and "anotherFile.txt" to read polynomials. According to the second line, you know you should output the products of the polynomials for `x`, `z`, and `y` in order, each in a single line. You should output polynomials in the same format as in the input files. Therefore, the output of your program should be

```
x^6 + x^5 - x^3 - x^2
z^3 - z^2
y + 2
```

Please note that you should output the product for `z` before that for `y`. Please also note that the product for `x` comes from three different polynomials while that for `y` comes from only one polynomial. For each variable contained in the second line of the main input file, there is at least one polynomial for it in the polynomial files.

To control the difficulty of this homework, let's make the following assumptions. There are at most five polynomial files and exactly 35 variables. For each variable, there are at most ten polynomials distributed in the five polynomial files. For each given polynomial, the highest order is five. All the polynomials are presented from the highest-order term to the lowest-order term. All the coefficients in the given or output polynomials are integers. These coefficients can be stored in `int` variables.

Grading criteria

- 70 points are given based on the correctness of your output. Each correct line of output gives you two points. Among the 35 variables, each of the first ten has only one polynomial. So for each of the first ten variables, you just need to read that polynomial and then print it out. The next ten variables have their polynomials containing just one term. If you cannot write a program that deals with general polynomials, at least handle these two special cases to get some credits.
- 30 points 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.

(Bonus) Problem 2

(20 points) There are a new main input file and several new polynomial files to contain polynomials for ten variables. However, now a term in a given polynomial may contain white spaces. For example, polynomial $3x^3 + 10x^2 - 5$ may be stored as

```
3 x ^ 3 + 1 0x^ 2       - 5
```

in the polynomial files. Your program should remove those white spaces before doing the task required as in Problem 1. The polynomial you output should also have no white space inside each term.