Programming Assignment #2: Polynomial GCD

(due 23:59, Oct 29th, 2019)

Introduction:

The greatest common divisor(GCD) for two or more univariate polynomials is important and elementary in algebra. For example, polynomial GCD can be used in root-finding algorithm when polynomials have multiple roots. Further, GCD computations allow us to compute the square-free factorization, even for multivariate polynomials. In computer algebra systems, most of the modern theory of polynomial GCD has been developed to satisfy the need of efficiency.

Objective:

In this programming assignment, you are asked to write a C++ program to derive the GCD of two univariate polynomials and return the GCD.

Provided files:

(1) ***main.cpp***: it executes the function *FindGCD*() and checks the answer. It can be changed if necessary for you to debug.

(2) ***GCD.cpp*** & ***GCD.h***: these are the program files you need to implement. The function *FindGCD()* receives two arrays, each of the arrays contains all the coefficients from 1 input polynomial. *FindGCD()* will return the GCD of input polynomials in the same way(as a coefficient array).

(3) ***example***: this is an exemplary input test case, which can be used to test your program.

Implementation Details:

The polynomial $A_0x^0+A_1x^1+A_2x^2+A_3x^3+\cdots+A_{998}x^{998}+A_{999}x^{999}$ will be stored in a **long integer** array with size=1000 as follows:

array[0]	array[1]	array[2]	……..	array[998]	array[999]
A_0	A_1	A_2	……..	A_{998}	A_{999}

The two inputs and the answer will all be stored in this format, and the output of *FindGCD()* should also be stored in the same way, with the same array size.

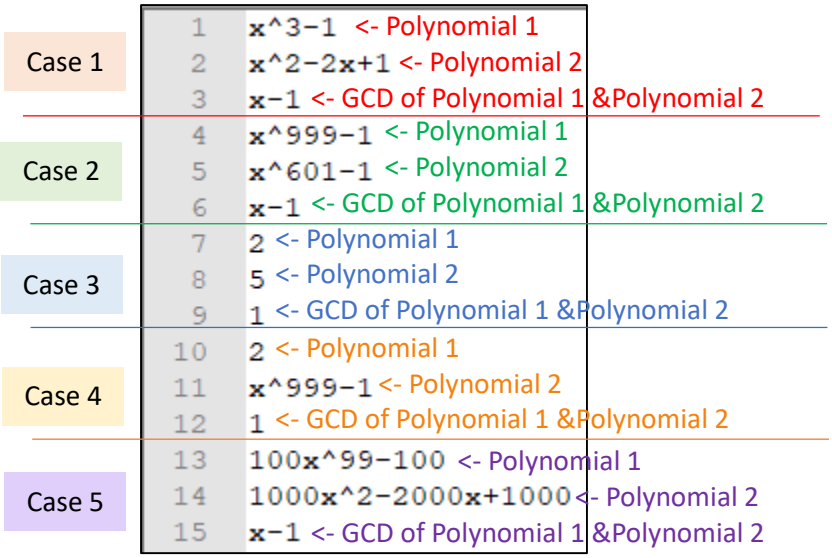
The returned GCD should be a **polynomial function with irreducible integral coefficients**, and **the coefficient of the highest power of the variable should be positive**. If there is no GCD between two inputs, you should return 1. Also, if both of

the input are zero-degree polynomials (constant polynomials), you should return 1 as well.

Example:

GCD you calculate	GCD you should return
3x^3-6	x^3-2
-3x^3+6	x^3-2
6	1

The input file will look like this:



There are 900 test patterns in the example case. The first and the second lines indicate 2 input polynomials, and the third line is the golden answer (the GCD of the input polynomials).

* Note that the input polynomials would all be nonzero polynomials, and the coefficients will always be smaller than **INT_MAX**. However, the coefficients may exceed **INT_MAX** during your calculation. (**INT_MAX**= 2^31-1=2147483647 and the size of **long** integer is 8byte under Linux system)

Language:

C or C++.

Platform:

You may develop your software on UNIX/Linux.

Compile: $ g++ main.cpp GCD.cpp

Execution: $ ./a.out

Submission

Please compress the following files into a zip file and name it by your ***name and student ID***. For example, **"HW2_0750264_陳玥融.zip"**. Then upload the compressed file to the new E3 website by the deadline (Oct 29th,2019).

(1) GCD.h
(2) GCD.cpp

Grading policy:

(1) Example case correctness (60%)
(2) Hidden case correctness (10%)
(3) Hidden case ranking (30%, ranked by run time)