Assignment 6 – Polynomial

Date assigned: Monday, April 13, 2009
Date due: Wednesday, April 29, 2009
Points: 45pts

In mathematics, a polynomial is the sum of terms of the form **ax^e** where **a** is the coefficient, **x** is a variable, and **e** is an exponent. An example of a polynomial might be: $5.3x^2 + 2.0x^1 + 5x^0$. A univariate polynomial has a single variable used throughout the entire polynomial such as x used in the previous example. The degree of a polynomial is the largest exponent of all of the terms.

For this assignment, you are to use everything you've learned thus far in this course to create the mathematical concept of a polynomial in C++. The exponents of the polynomial are to be of type integer whereas the coefficients of the polynomial are to be double. There can be at most 50 terms in each polynomial object. You are to create a class called Polynomial with the definition stored in a file called "Polynomial.h" and the implementation in a file called "Polynomial.cpp". Create and use other classes in the creation of a polynomial as you see fit.

The functions of your class polynomial must be:

1. **degree** prints the degree of the polynomial.
2. **input** reads a polynomial in from the keyboard of the form: n e_1 c_1 e_2 c_2 e_3 c_3 ... e_n c_n, where e_i represents an exponent and c_i represents a coefficient and n gives the number of terms in the polynomial. Each input value is separated by one or more whitespace characters.
3. **operator<<** prints a polynomial in the form: 5.00X^3 + 3.00X^2 - 15.00X^1
4. **operator+** is an overloaded operator that adds two polynomials
5. **operator-** is an overloaded operator that subtracts two polynomials.
6. **evaluate** evaluates a polynomial for a given value of X.

How you decide to implement your polynomial class is up to you, but the following program segment must produce the desired result:

```
Polynomial cPoly1, cPoly2, cPoly3;
....
cPoly1.input();
cPoly2.input();
cout << cPoly1.degree() << endl;
cout << cPoly1 << endl;
cPoly3 = cPoly1 + cPoly2;
cout << cPoly3 << endl;
cPoly3 = cPoly1 - cPoly2;
cout << cPoly3 << endl;
cout << cPoly1.eval(2) << endl;
Polynomial cPoly4 = cPoly3;
cout << cPoly4 << endl;
```

Input data:
```
1 5 2
2 5 3 2 1
```

would produce the following output for the above program segment:
```
5
2.00X^5
5.00X^5 + 1.00X^2
-1.00X^5 – 1.00X^2
64.00
-1.00X^5 – 1.00X^2
```

Note1: For the output of floating point numbers, use two significant decimal places for each float output.

Note2: All polynomials will be entered from highest exponent to lowest exponent value.

Goals for Assignment 6:
1. Get experience in designing your own classes.
2. Use the C++ coding standards Version 5 with your object-oriented code.
3. Use the .h/.cpp separate file design for defining and implementing classes.
4. Implement at most one constructor or function at a time and make sure to extensively test the constructor or function before going on. I promise you that on this assignment if you write too much code you will have extreme difficulties getting the code to compile and run.

What to Submit:
- Save your project as 06PolynomialPUNet. So as an example, mine would be 06Polynomialkhoj0332.
- Your code is to be written using Visual Studio and placed in the CS250 Drop Box by 9:15am on the day in which the assignment is due. A stapled hard copy must be placed on the instructor's desk before 9:15am on the day the assignment is due.