

Programming Assignment #2

Linked Lists

Be sure to design your own “**pointer-based linked lists**” in this programming assignment (array-based linked lists will not be graded). You are not allowed to use any container in the Standard Template Library (STL), or any other open-source library, such as vector, list, map, set, and all the other container classes. The submitted source codes will NOT be graded if those open-source container classes are found in your source codes.

1. Problem Description

The goal of this project is to create a C++ program that performs various operations on polynomials using a linked list to represent and manage polynomial terms. The program **should** support the following operations:

We have two polynomials in this program (Poly1, Poly2).

- A. **Insertion:** Users can insert new terms into a polynomial. The terms are represented by a coefficient and an exponent. The program should maintain the terms in sorted order based on their exponents.
- B. **Display:** The program should be able to display the polynomial in a human-readable format.
- C. **Addition:** The program should allow users to add two polynomials and return the result as a new polynomial. (Poly1+Poly2)
- D. **Subtraction:** Users should be able to subtract one polynomial from another and get the result as a new polynomial. (Poly1-Poly2)
- E. **Multiplication:** Users can multiply two polynomials and obtain the result as a new polynomial. (Poly1*Poly2)
- F. **Evaluation:** The program should provide the functionality to evaluate a polynomial for a given value of 'x' and return the result.

2. Input Format

Two polynomial's coefficients and x from the **input file**.

The coefficients of polynomials will be between -100~100, and $-100 < x < 100$.

And the power of polynomials will be between 0~10.

3. Output Format

Polynomial 1: Poly1.

Polynomial 2: Poly2.

Addition: Addition result.

Subtraction: Subtraction result.

Multiplication: Multiplication result.

Evaluation of Polynomial 1 at $x = ?$ is: Poly1 Evaluation result.

Evaluation of Polynomial 2 at $x = ?$ is: Poly2 Evaluation result.

// ? according to input.

4. Sample Input / Output

Input :

Poly1

3 2 // $3x^2$

-5 1 // $-5x^1$

2 0 // $2x^0$

Poly2

4 3 // $4x^3$

2 1 // $2x^1$

7 0 // $7x^0$

$x = 2$

Output : // Please output directly on the terminal.

Polynomial 1: $3x^2 - 5x^1 + 2x^0$

Polynomial 2: $4x^3 + 2x^1 + 7x^0$

Addition: $4x^3 + 3x^2 - 3x^1 + 9x^0$

Subtraction: $-4x^3 + 3x^2 - 7x^1 - 5x^0$

Multiplication: $12x^5 - 20x^4 + 14x^3 + 11x^2 - 31x^1 + 14x^0$

Evaluation of Polynomial 1 at $x = 2$ is: 4

Evaluation of Polynomial 2 at $x = 2$ is: 43

5. Submission Information

1. Your program must be written in C/C++ language and can be compiled on the Linux platform.
2. Please put the required files in a folder named with your Student_ID and the required files should also be named with your Student_ID (.cpp, .c).
3. To submit your program, please use the command below to compress the folder named with "[Student_ID].tar" in the Linux environment and upload it to E3.

`tar cvf Student_ID.tar Student_ID`

```
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$  
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$ ls  
311580053/  
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$ ls ./311580053/*  
./311580053/311580053.cpp  
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$ tar cvf 311580053.tar 311580053/  
311580053/  
311580053/311580053.cpp  
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$ ls  
311580053/ 311580053.tar  
16:10 jacklo311580053@vda04 [~/DS_2023fall/lab1] >$ █
```

6. Due Date

Be sure to upload the tar file by “**October 31, 2023**”. There will be a 10% penalty per day for the first four days (weekend included) and will not be accepted afterwards.

7. Grading Policy

The programming assignment will be graded based on the following rules:

- Pass the open cases with compilable source code (60%)
- Pass the hidden cases with compilable source code (40%)
- -10% of your total score if any file occurs naming error or not compress
- **No credits for plagiarism**

```
18:51 redy411490@vda04 [~/CA] >$ g++ Lab2.cpp -o Lab2  
18:51 redy411490@vda04 [~/CA] >$ ./Lab2 input1.txt  
Polynomial 1: 3x^2 - 5x^1 + 2x^0  
Polynomial 2: 4x^3 + 2x^1 + 7x^0  
Addition: 4x^3 + 3x^2 - 3x^1 + 9x^0  
Subtraction: -4x^3 + 3x^2 - 7x^1 - 5x^0  
Multiplication: 12x^5 - 20x^4 + 14x^3 + 11x^2 - 31x^1 + 14x^0  
Evaluation of Polynomial 1 at x = 2 is: 4  
Evaluation of Polynomial 2 at x = 2 is: 43  
18:52 redy411490@vda04 [~/CA] >$ █
```