Department of Computer Science and Engineering
Indian Institute of Technology Jodhpur
CSL2020 - Data Structures and Algorithms

January 10, 2022

Lab - 1

1. **Using linked list**, write a **C program** to evaluate polynomials: P1(x), P2(x), and P3(x) where P1(x) and P2(x) are input polynomials and P3(x) is obtained by merging P1(x) and P2(x) in such a manner that the total number of terms in P3(x) is equal to the sum of the number of terms in P1(x) and P2(x) and the highest degree of P3(x) is the smallest integer greater than the sum of the highest degrees of P1(x) and P2(x). Rest of the terms are adjusted accordingly. For example, P1(x) = $a_N x^N + a_{(N-1)}x^{(N-1)} + ... + a_0 x^0$ and P2(x) = $b_M x^M + b_{(M-1)}x^{(M-1)} + ... + b_0 x^0$ then P3(x) is obtained as P3(x) = $a_N x^{(N+M+1)} + a_{(N-1)}x^{(N-1+M+1)} + ... + a_0 x^{(M+1)} + b_M x^M + b_{(M-1)}x^{(M-1)} + ... + b_0 x^0$. Each node in the linked list correspond to a term in the polynomial. So, in your node structure - you may keep two data components – integers pow and coeff; and one pointer to the next node.

   Input Format: First line mentions K i.e. the number of test cases. Then there are three lines for each test case, In the first two lines of a test case, First number indicate the highest degree of polynomials N and then there are N+1 integers which are the coefficients of polynomial terms in descending order. In the third (and last line) of a test case, there is one integer i.e. value of x for which you need to evaluate the polynomials. (Constraints: $0 \leq K \leq 50$, $0 \leq N \leq 9$, $-2 \leq x \leq 2$, and Input coefficient terms would be between -100 to +100; Assume you can safely do calculations for each polynomial term without worrying about underflow/overflow issues).

Sample Input 1:
1
7 1 0 0 0 10 -3 0 1
3 4 0 0 -2
2

Explanation of Input Format (Considering 2nd Polynomial mentioned above)

3	4	0	0	-2
Highest degree of polynomial	Coefficient of x^3	Coeff of x^2	Coeff of x^1	Coeff of x^0

Question 1 continues on the next page...

$7\ 1\ 0\ 0\ 0\ 10\ -3\ 0\ 1 \longrightarrow x^7 + 10x^3 - 3x^2 + 1$

$3\ 4\ 0\ 0\ 2 \longrightarrow 4x^3 - 2$

$2 \longrightarrow$ value of x should be in range of -2 to 2.

Sample Output 1:

P1(x) = 1x^7 + 10x^3 - 3x^2 + 1
P2(x) = 4x^3 – 2
P3(x) = 1x^11 + 10x^7 - 3x^6 + 1x^4 + 4x^3 – 2
P1(2) = 197
P2(2) = 30
P3(2) = 3182