



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, $P1(x) = a_N x^N + a_{(N-1)} x^{(N-1)} + \dots + a_0 x^0$ and $P2(x) = b_M x^M + b_{(M-1)} x^{(M-1)} + \dots + b_0 x^0$ then $P3(x)$ is obtained as $P3(x) = a_N x^{(N+M+1)} + a_{(N-1)} x^{(N-1+M+1)} + \dots + a_0 x^{(M+1)} + b_M x^M + b_{(M-1)} x^{(M-1)} + \dots + b_0 x^0$. 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

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

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

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

Sample Output 1:

$$P1(x) = 1x^7 + 10x^3 - 3x^2 + 1$$

$$P2(x) = 4x^3 - 2$$

$$P3(x) = 1x^{11} + 10x^7 - 3x^6 + 1x^4 + 4x^3 - 2$$

$$P1(2) = 197$$

$$P2(2) = 30$$

$$P3(2) = 3182$$