
Programming Assignment 1

Name : Manan Darji

Roll Number : CS22MTECH14004

Subject : Advance Data Structure and Algorithm (CS6013)

Topic : Multiplying Two Polynomials

Flow Of Code:

- I Have Used **Fast Fourier Transform** to Implement problem of Multiplying Two Polynomials.
- Code will give you both output.
 1. For naive approach
 2. For FFT approach

1. For naive approach

- For Naive Approach we'll just multiply each term of first polynomial with each term of second polynomial.
- This will take $O(N^2)$ Time.

2. For FFT approach

- Using Fast Fourier Transform will Give Us Time complexity as $O(N\log(N))$.
- first we'll convert both polynomial to point value representation in $O(N\log(N))$ using Fast Fourier Transform.
- then we'll multiply both of them using simple multiplication of complex number in $O(N)$.
- After which we'll convert resulting point value representation to polynomial coefficient representation in $O(N\log(N))$ using Inverse Fast Fourier Transform.
- At end we normalized the output of IFFT.

How output of code looks like

```
-----  
Please enter degree of Polynomial 1 : 4  
Please enter 5 coefficients for polynomial 1 in the increasing order of the degree  
of the monomials  
5 4 8 7 9  
-----  
Please enter degree of Polynomial 2 : 3  
Please enter 4 coefficients for polynomial 2 in the increasing order of the degree  
of the monomials  
2 5 4 8  
-----  
polynomial 1 :  $9x^4 + 7x^3 + 8x^2 + 4x + 5$   
polynomial 2 :  $8x^3 + 4x^2 + 5x + 2$   
-----  
polynomial Product (Naive) :  $72x^7 + 92x^6 + 137x^5 + 117x^4 + 110x^3 + 56x^2 +$   
 $33x + 10$   
-----  
polynomial Product ( FFT ) :  $72x^7 + 92x^6 + 137x^5 + 117x^4 + 110x^3 + 56x^2 +$   
 $33x + 10$   
-----  
Both Naive And FFT Output Are Same, All Good!  
-----
```