Polynomial Arithmetic using Fast Fourier Transform

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Description

The assignment focuses on polynomial arithmetic using the operation of Fast Fourier Transform.
Generally polynomial operations like multiplication and division may take O(n2) time using ordinary methods but using the methods of FFT , the above operations can be done in O(nlog(n)) time.

Operations Implemented

The following operations on polynomials have been implemented :

- Addition
- Subtraction
- Multiplication
- Reciprocal
- Division

Reciprocal has also been achieved on O(nlog(n)) time using some shifting techniques and properties of the iterative formula used for computing the reciprocal.

Usage of Program

Once the program is started , it will ask which operation is to be performed.
After specifying the operation , it will input the required polynomial(s).

Example polynomial : 4x3 + 3x2 + 2x + 1
For entering the polynomial , it asks for the following info :
Polynomial size : specify the number of coefficients (4 in the above example)
Coefficients : Enter the coefficients in decreasing order of degree separated by space (4 3 2 1 in the above example)

After entering the above data , the result will be displayed.

Enter “end” at the operation input to exit the program.

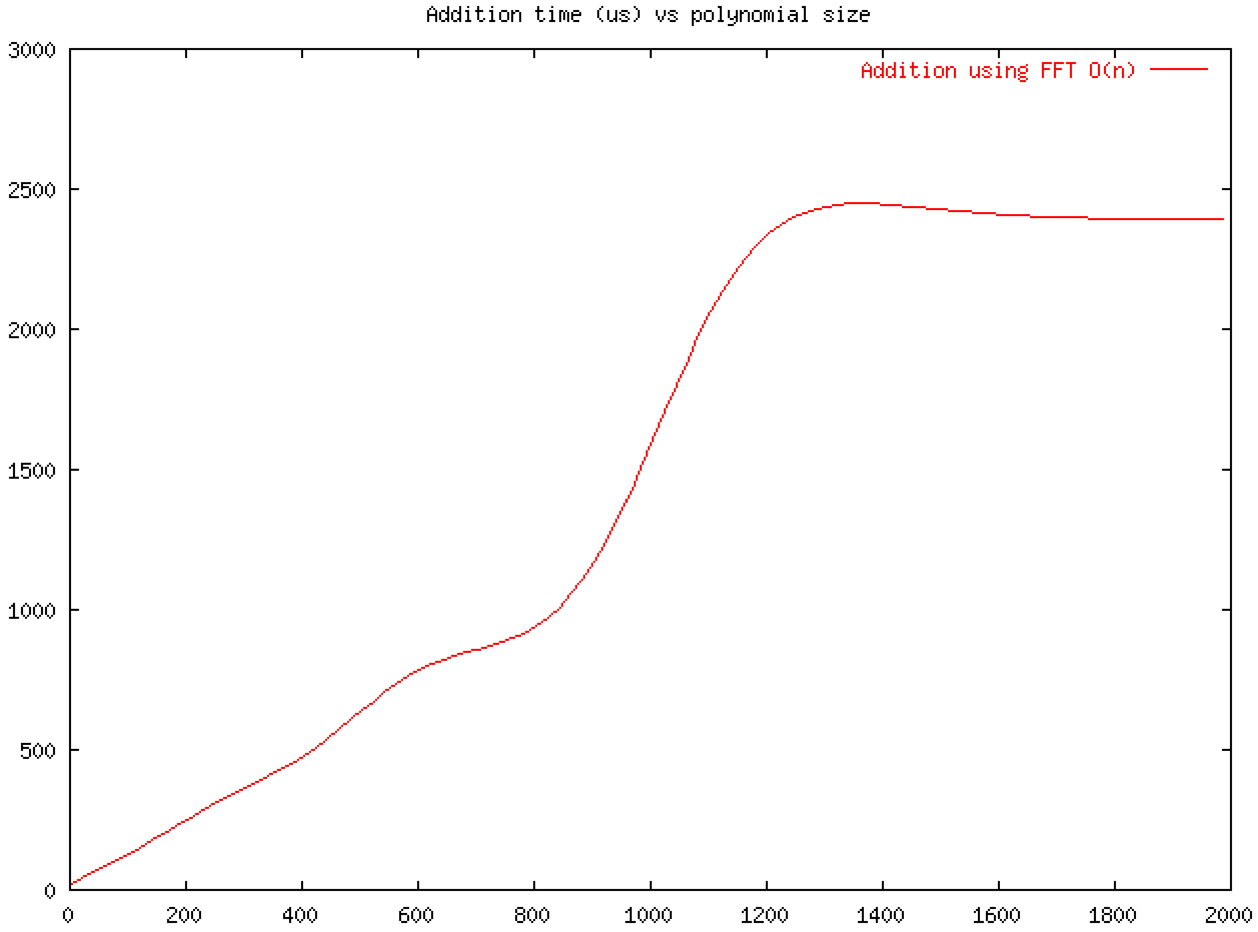
Efficiency Analysis

The following operations were analysed for running time :

- Addition
- Multiplication
- Reciprocal

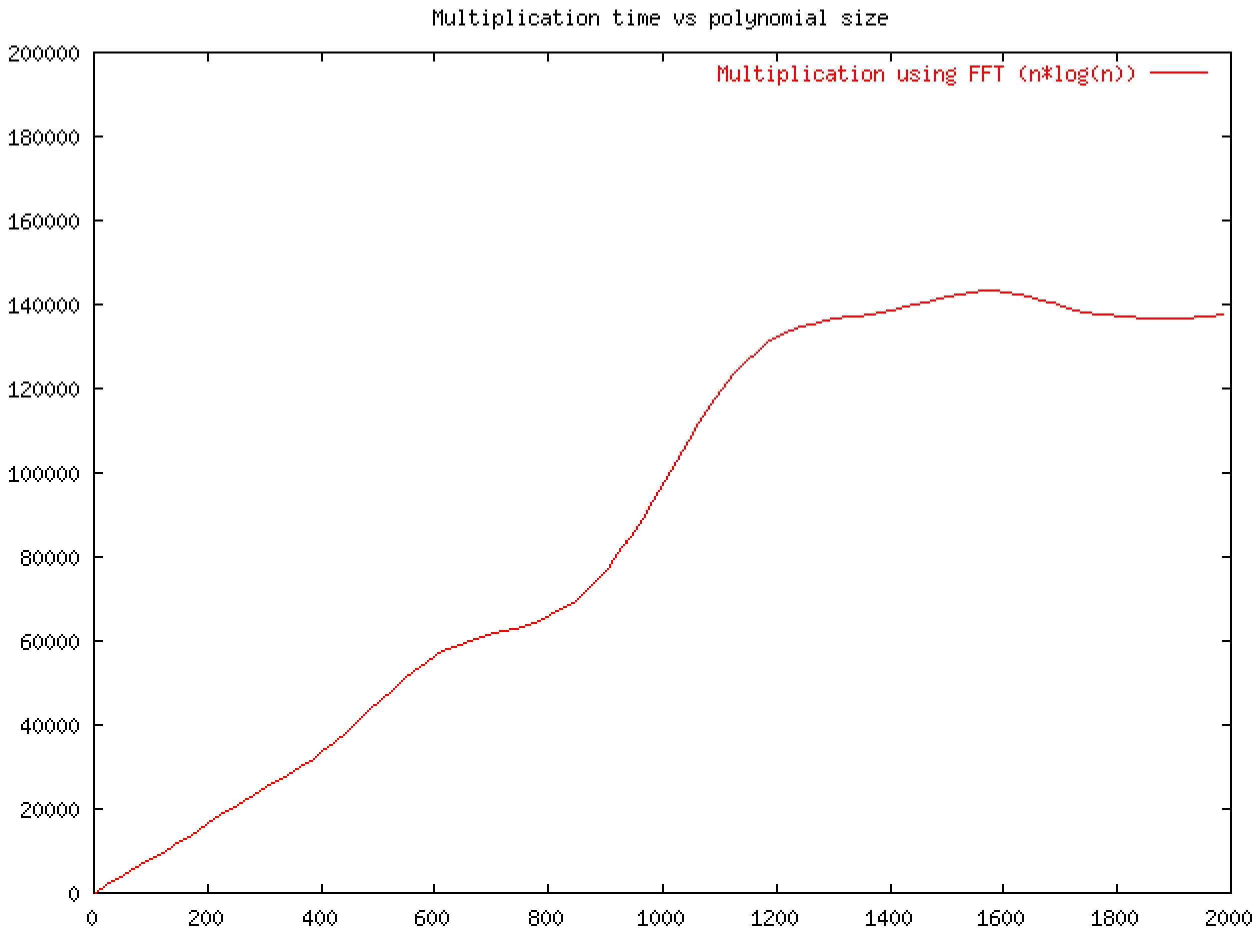
Addition

Addition takes place in O(n) time.
Following graph was obtained for addition :



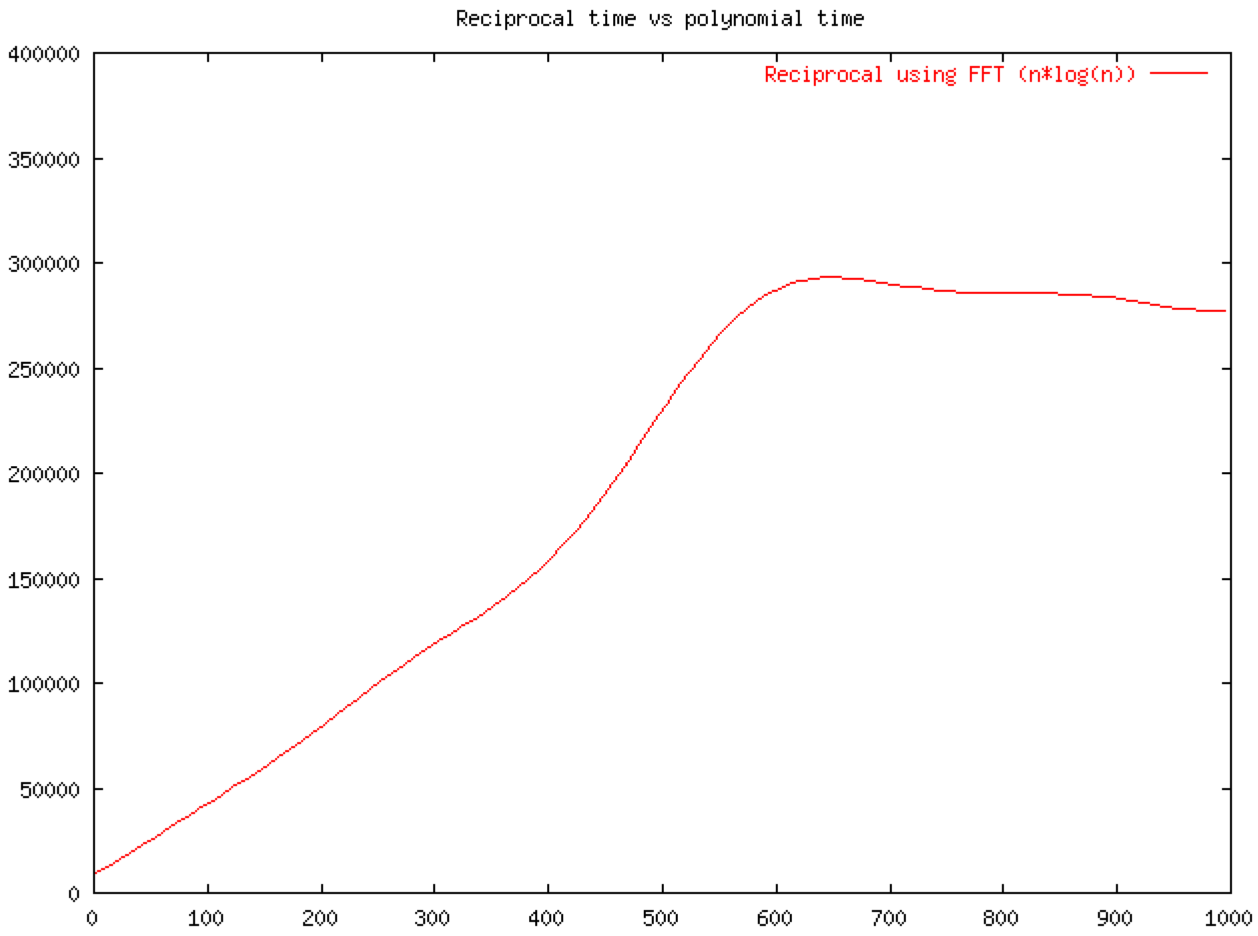
Multiplication

Multiplication takes place in O(nlog(n)) time.
Following graph was obtained for multiplication :



Reciprocal

Reciprocal takes place in O(nlog(n)) time using some shifting techniques.
Following graph was obtained for reciprocal.



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