Algorithms

Regular multiplication

- O(n^2)
- Distribute each term of the first polynomial to every term of the second polynomial. When multiplying two terms, multiply their coefficients (numbers) and add their exponents. Add up the terms resulting from multiplications with the same exponent.

Karatsuba mutiplication

- O(n^log3)
- The Karatsuba algorithm is a fast multiplication algorithm that uses a divide and conquer approach to multiply two numbers. The point of this algorithm is to break large numbers down into smaller numbers so that any multiplications that occur happen on smaller numbers.

Distributing the workload to each node was done by dividing the polynomial length to the number of worker processes (namely MPI.size()-1 because we exclude the master process) and then going step by step with this computation, until the last worker process was reached.
At each iteration i, MPI.send is used to send data to be computed by the worker node i.
The node sends in return an incomplete result. After all the sending was done, the master process receives all the incomplete results and adds them up to the final result.

Experiments

Polynomial order	Approach	Nodes	Time (ms)
5	Simple Product	4	18
5	Karatsuba Product	4	11
100	Simple Product	4	15
100	Karatsuba Product	4	37
1000	Simple Product	4	71
1000	Karatsuba Product	4	223
2500	Simple Product	4	125
2500	Karatsuba Product	4	417
5	Simple Product	8	13
5	Karatsuba Product	8	22
100	Simple Product	8	17
100	Karatsuba Product	8	48
1000	Simple Product	8	106
1000	Karatsuba Product	8	533
2500	Simple Product	8	189
2500	Karatsuba Product	8	578