PDP Lab 5 – Polynomial Multiplication

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Problem Requirements

Algorithm Descriptions

Regular polynomial multiplication
- Complexity: $O(n^2)$
- Step 1: Distribute each term of the first polynomial to every term of the second polynomial. When you multiply two terms together you must multiply the coefficient (numbers) and add the exponents.
- Step 2: Sum up the terms resulted from the multiplications which result in the same exponent, the solo ones stay the same.

Karatsuba algorithm
- Complexity: $O(n^{logn})$
- A fast multiplication algorithm that uses a divide and conquers approach to multiply two numbers.

Computer Specifications

- Intel Core i7-4790 CPU @ 3.60GHz, 4 Cores, 8 Logical Processors
- 16GB RAM

Tests Run

Times are measured in ms

Order	Regular Seq	Parallel Seq	Regular Ktsb	Parallel Ktsb
10	1	57	1	7
50	2	63	9	13
100	6	75	17	18
500	35	80	66	67
1000	46	125	126	43
5000	437	415	524	196

Conclusions

1. As expected, the regular multiplication starts losing to Karatsuba time-wise as the order of magnitude grows higher and that log makes a difference.
2. Parallelizing the regular multiplication does more bad than good when n is small, as the cost of thread creation is quite large.
3. Parallelizing Karatsuba is advantageous due to the ability of doing multiple things at once.