Data Structures and Algorithms I

05 - Tutorial: Analysis

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Linked Lists

- Using your linked list implementation, investigate the Big-Oh complexity of add, remove functions

- This is a check that they are O(n), and serves as a test of your implementation

- Learn how to time functions and plot the timing results for a plot of n vs. t

Multiplication

For example, to multiply 238 by 13, the smaller of the numbers (to reduce the number of steps), 13, is written on the left and the larger on the right. The left number is progressively halved (discarding any remainder) and the right one doubled, until the left number is 1:

Lines with even numbers on the left column are struck out, and the remaining numbers on the right are added, giving the answer as 3094:

$$13 \times 238$$

13		238
6	(remainder discarded)	476
3		952
1	(remainder discarded)	1904

13	238
~~6~~	~~476~~
3	952
1	+ 1904
	3094

Analysis

- What is the Big-Oh complexity of the Russian Peasant's multiplication algorithm?

- Implement the algorithm in Java (using ints/longs) and verify correctness

- To allow larger inputs, change the implementation to BigInteger.

- Time the function from n=[100, 10,000,000]

- Plot the results and check the complexity scaling.

- Compare with the complexity of Java BigInteger multiplication