Multiplication Algorithms

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1 Grade-school multiplication

Suppose we multiply two n-digit integers $(x_1 x_2 \dots x_n)$ and $(y_1 y_2 \dots y_n)$ using the grade-school multiplication algorithm. How many pairs of digits x_i and y_j get multiplied in this algorithm?

- ○ n^3
- ○ $2n-1$
- ● n^2

Correct

What is the smallest exponent x such that the number of one-digit operations in grade-school multiplication is always at most $10000 \cdot n^x$?

2

Correct

2 Divide-and-conquer multiplication

Suppose that we have a divide-and-conquer algorithm $\mathcal{A}$ that multiplies two n-digit integers by recursively calling itself to perform t number of $\lceil n/2 \rceil$-digit integer multiplications; when $n \leq 1$, it performs single-digit multiplication.

If $t = 4$, what is the smallest exponent x such that the number of one-digit multiplications is always at most $10000 \cdot n^x$?

2

Correct

For what values of t does the algorithm perform fewer one-digit multiplications than the grade-school multiplication algorithm for inputs that have $n > 10000$ digits?

- ○ For all values of t
- ○ $t = 1, 2$
- ● $t = 1, 2, 3$
- ○ $t = 1, 2, 3, 4$

Correct

What is the value of t for Karatsuba integer multiplication algorithm?

3

Correct