## 1 Grade-school multiplication

Suppose we multiply two $n$-digit integers $\left(x_{1} x_{2} \ldots x_{n}\right)$ and ( $y_{1} y_{2} \ldots y_{n}$ ) using the grade-school multiplication algorithm. How many pairs of digits $x_{i}$ and $y_{j}$ get multiplied in this algorithm?
○ $n^{3}$
O $2 n-1$
O $n^{2}$

## 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 $10000 \cdot n^{\times}$?

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?
O For all values of $t$
O $t=1,2$
O $t=1,2,3$
O $t=1,2,3,4$

## Correct

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

