

(C) $(n_1 \times n_2)(n_1 \times n_2)(n_1 \times n_2) \dots$ (Since both n_1 and n_2 have N_1 and N_2 digits).

If we divide this into groups of 2 we will get $n/2$.

Since grade school multiplication is $O(\log_{10}(n)^2)$ this will be $\frac{n}{2} \log(n)^2$

Repeat steps:

$$t(n) = \frac{n}{2} \log(n)^2 + \frac{n}{4} \log(n)^4 + \dots + \frac{n}{2^k} \log(n)^{2^k}$$

until $2^k = n$, ($k = \log_2 n$)

$$t(n) = \frac{n}{2^k} \log(n)^{2^k} + \frac{n}{2^{k-1}} \log(n)^{2^{k-1}} + \dots + \frac{n}{2^0} \log(n)^{2^0}$$

$$= \sum_{i=1}^k ((2^k \log n)(n/2^k))$$

$$\therefore O(n) = nK \log_{10}(n), \text{ where } K = \log_2 n$$