

Karatsuba Algorithm

↳ divide and conquer algo

Let us suppose we have two numbers n and y , 146123 and 352120

$$n = \begin{array}{c} a \\ 146 \end{array} \begin{array}{c} b \\ 123 \end{array} \quad (\text{splitting})$$

$$y = \begin{array}{c} c \\ 352 \end{array} \begin{array}{c} d \\ 120 \end{array}$$

$$n = a * 10^{n/2} + b$$

$$y = c * 10^{n/2} + d$$

$$\begin{aligned} n * y &= (a * 10^{n/2} + b) (c * 10^{n/2} + d) \\ &= ac * 10^{2(n/2)} + (ad + bc) * 10^{n/2} \\ &\quad + bd. \end{aligned}$$

so we find,

$$ac = \text{karatsuba}(a, c)$$

$$bd = \text{karatsuba}(b, d)$$

$$\begin{aligned} ad + bc &= \text{karabub} (a+b, c+d) \\ &\quad - ac - bd. \end{aligned}$$

Now implementing it in python