

Karatsuba Algorithm

↳ divide and conquer algo

Let us suppose we have two numbers x and y , 145123 and 352120

$$x = 145 \overset{a}{|} 123 \overset{b} \quad (\text{splitting})$$

$$y = 352 \overset{c}{|} 120 \overset{d}$$

$$x = a \times 10^{n/2} + b$$

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

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

So we find,

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

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

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

Now implementing it in python