

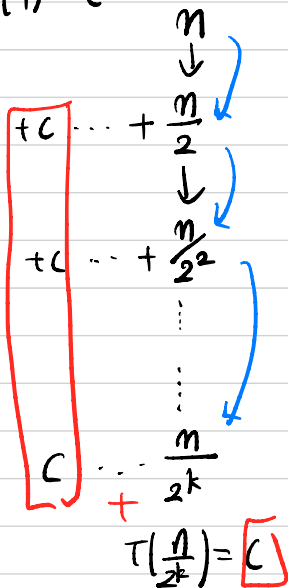
# 정렬

## 1. 이진 탐색 정렬

$$T(n) = T\left(\frac{n}{2}\right) + c$$

$$T(1) = c$$

가정  $n = 2^k$   
 $\Rightarrow k = \log_2 n$



$k$ 번 재귀  
 $\Rightarrow c$ 는  $k$ 번 생김  
 $= kc$  생김

$$T(n) = kc$$

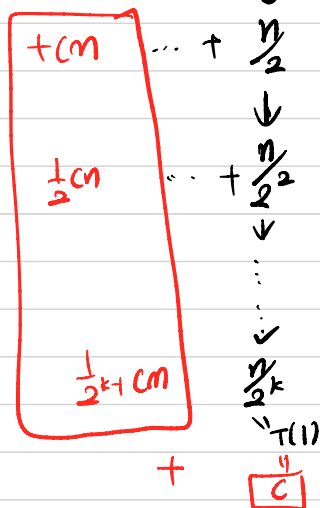
$$= O(k)$$

$$= O(\log_2 n)$$

## 2. Quick select best case

$$T(n) = T\left(\frac{n}{2}\right) + cn$$

$$T\left(\frac{n}{2}\right) = T\left(\frac{n}{4}\right) + \frac{1}{2}cn$$



$$cn \left( 1 + \frac{1}{2} + \dots + \frac{1}{2^{k-1}} \right) + c$$

$$\leq 2$$

$$= 2cn + c$$

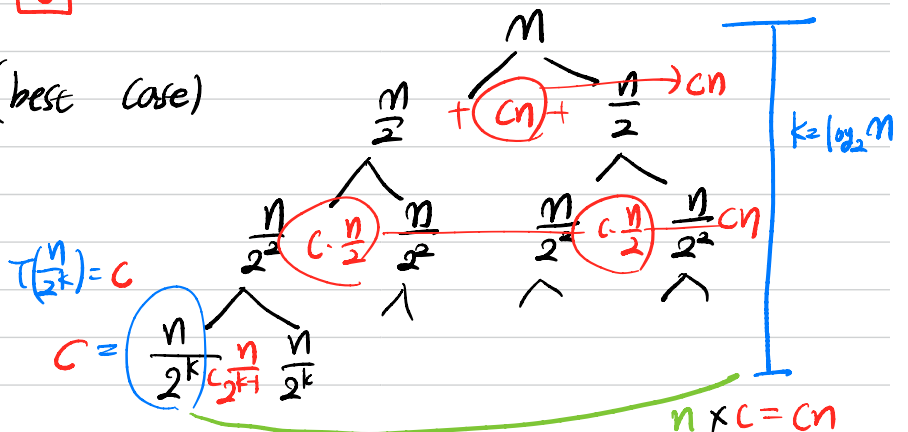
$$= O(n)$$

## 3. Quick Sort, merge sort (best case)

$$T(n) = 2 \cdot T\left(\frac{n}{2}\right) + cn$$

$$T(n) = cn \times \log_2 n$$

$$= O(n \log n)$$



# Karatsuba 알고리즘

$$T(n) = 3T\left(\frac{n}{2}\right) + cn$$

$$T(1) =$$

$$cn \left[ 1 + \frac{3}{2} + \frac{3^2}{2^2} + \dots + \left(\frac{3}{2}\right)^{k-1} \right] + c \cdot 3^k \quad k = \log_2 n$$

$$= cn \left( \frac{\left(\frac{3}{2}\right)^k - 1}{\frac{3}{2} - 1} \right) + c \cdot 3^k$$

$$= O(3^k) = O(3^{\log_2 n}) = O(n^{\log_2 3}) = O(n^{1.5})$$

4. Karatsuba  $\frac{n}{2} \times \frac{n}{2}$   $n = 2^k$   $k = \log_2 n$

$T(n) = 3 \cdot T\left(\frac{n}{2}\right) + cn$   
 $T(1) = c$

$cn \left( 1 + \frac{3}{2} + \frac{3^2}{2^2} + \dots + \left(\frac{3}{2}\right)^{k-1} \right) + c \cdot 3^k$

$= cn \left( \frac{\left(\frac{3}{2}\right)^k - 1}{\frac{3}{2} - 1} \right) + c \cdot 3^k$   $k = \log_2 n$

$= 2c \left( \frac{3^k}{2} \right) - 2cn + c \cdot 3^k$

$= 2c \cdot 3^k + c \cdot 3^k - 2cn$

$= O(3^k) = O(3^{\log_2 n}) = O(n^{\log_2 3}) = O(n^{1.5})$

$T(n) = 4T\left(\frac{n}{2}\right) + cn$   
 $= O(n^2)$