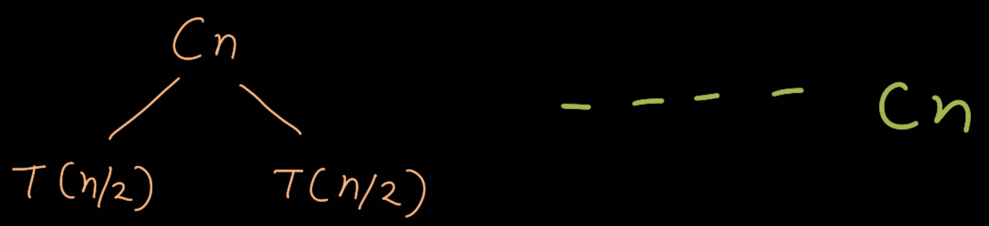
→ We consider the recursion tree and compute the total work done.

→ We write non-recursive part as root of the tree and write the recursive part as children.

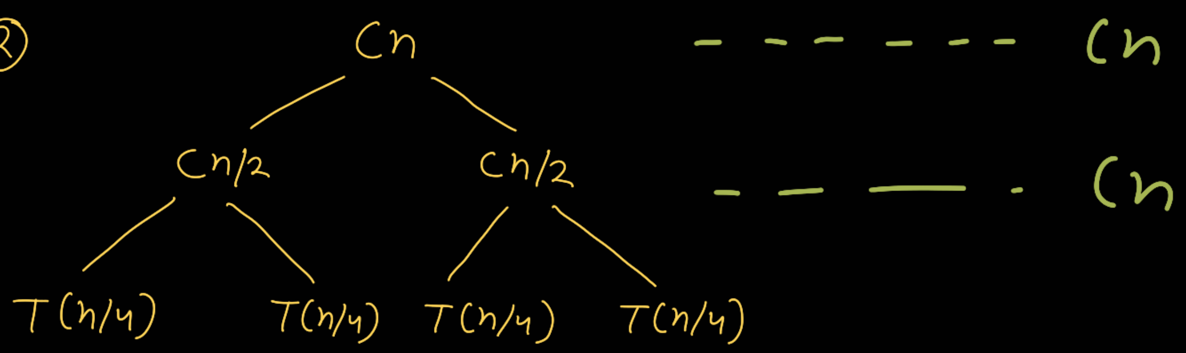
→ We keep expanding until we see a pattern.

$$T(n) = 2T(n/2) + cn$$
$$T(1) = c$$

①



②



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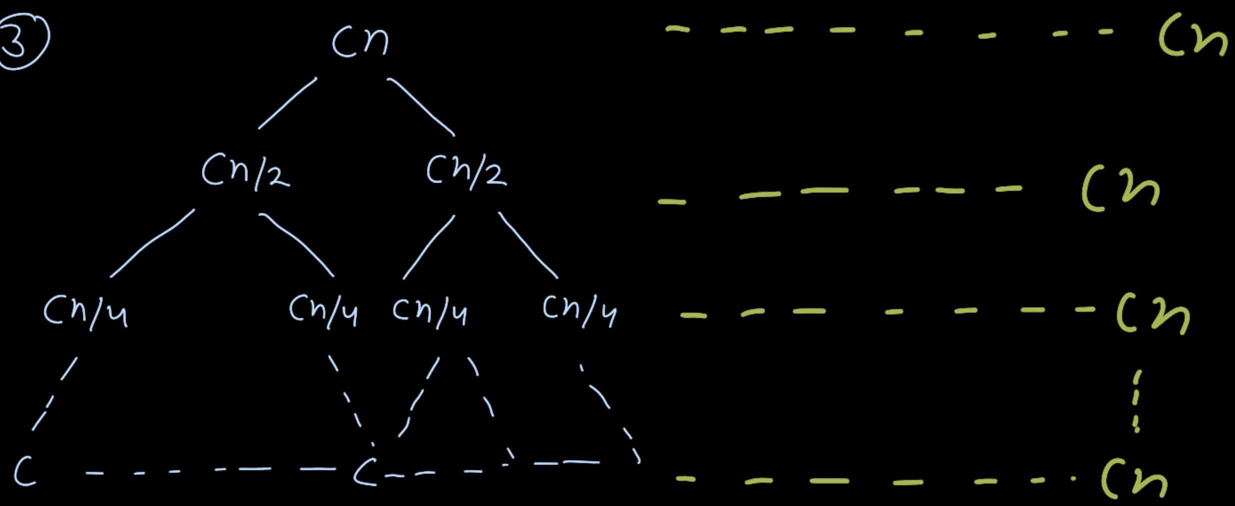


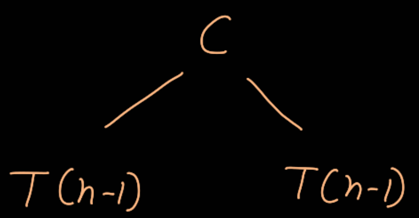
$$\underbrace{cn + cn + cn + \dots + cn}_{\Theta(\log n)}$$

$= \Theta(n \log n)$

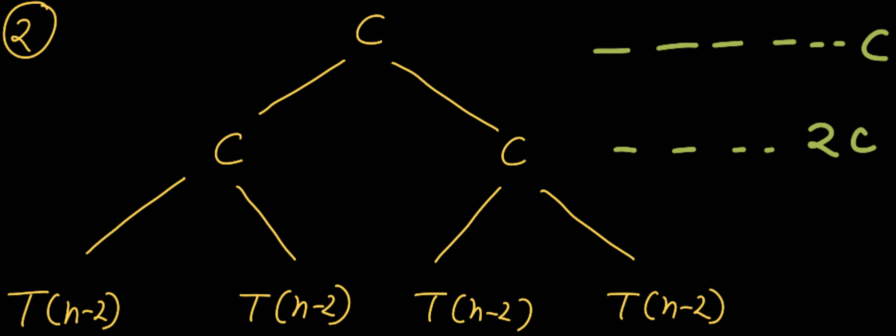
More Example Reccurrences

$$T(n) = 2T(n-1) + c$$
$$T(1) = c$$

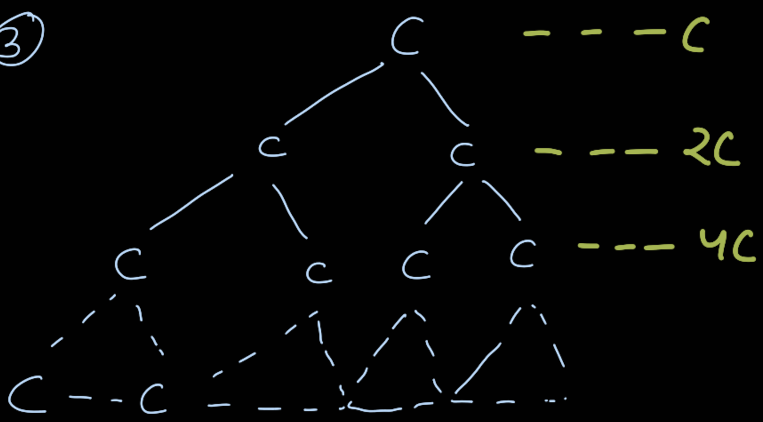
1



2



3



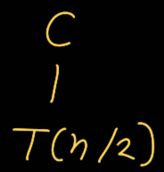
$$c + 2c + 4c + \cdots$$

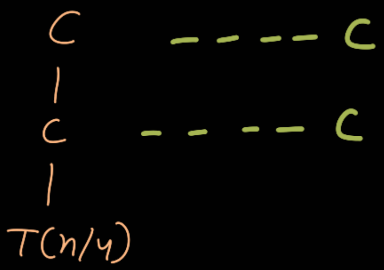
$$c[1 + 2 + 4 + \cdots]$$

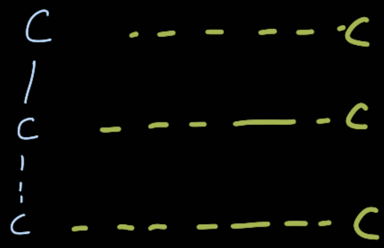
$$c\left[\frac{1 \times (2^n - 1)}{2 - 1}\right]$$

$$\Rightarrow \Theta(2^n)$$

$$T(n) = T(n/2) + 1$$
$$T(1) = c$$

① 

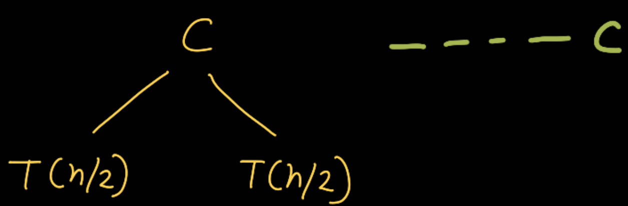
② 

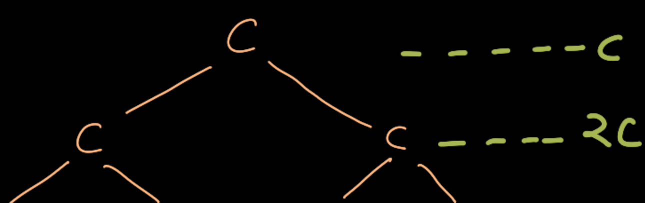
③ 

$$\underbrace{c + c + \cdots + c}_{(\log_2 n)+1}$$

$$= \Theta(\log_2 n)$$

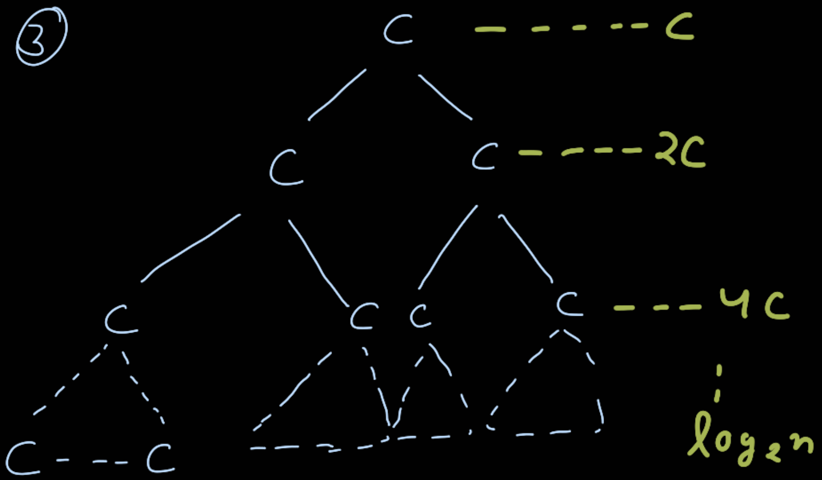
$$T(n) = 2T(n/2) + c$$
$$T(1) = c$$

① 

② 

$T(n/4) \quad T(n/4) \quad T(n/4) \quad T(n/4)$

3



$$\underbrace{c + 2c + 4c + \cdots}_{\Theta(\log_2 n)}$$

$$\Theta\left(\frac{2^{\log_2 n} - 1}{2 - 1}\right)$$

$$= \Theta(n)$$