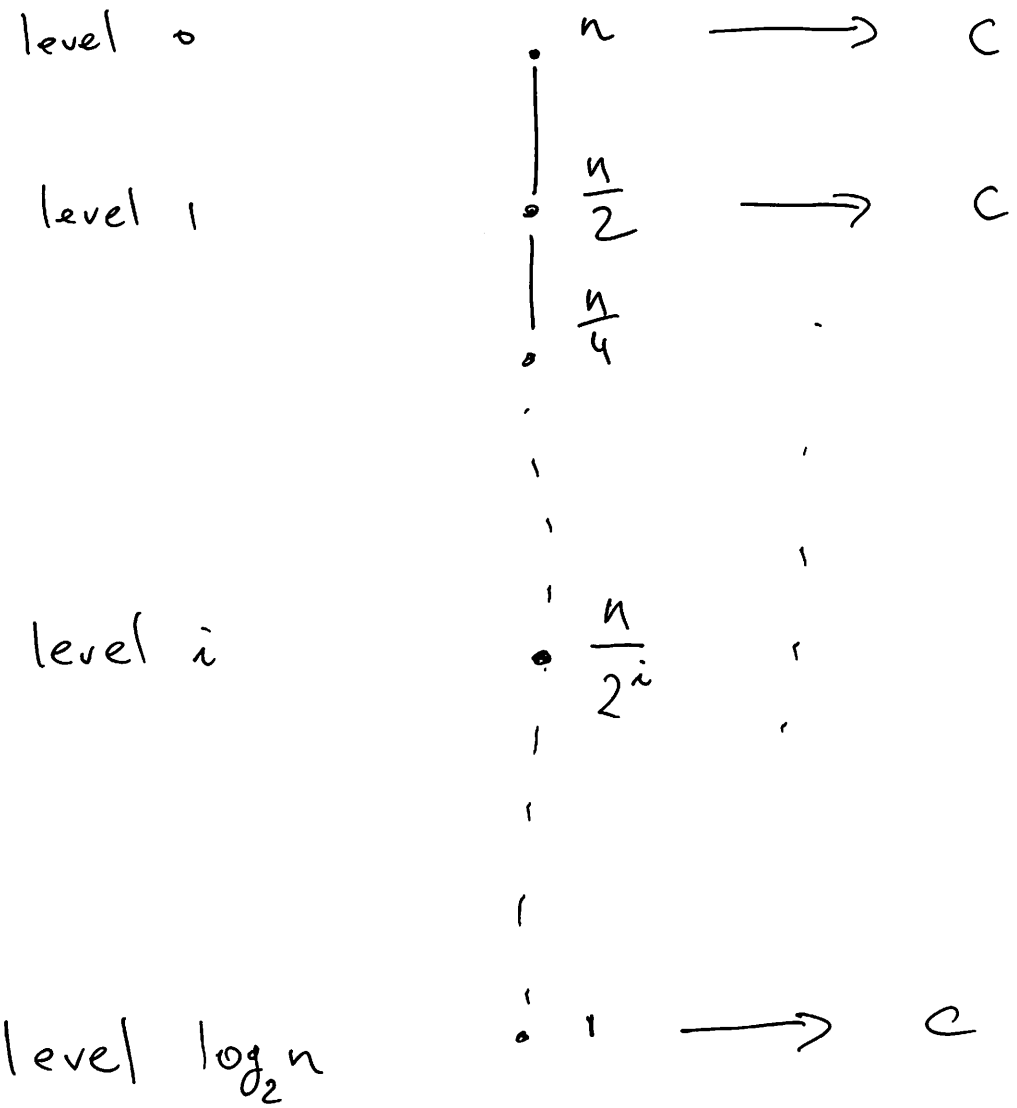
$$T(n) = \begin{cases} T\left(\frac{n}{2}\right) + c & n > 1 \\ c & n = 1 \end{cases}$$

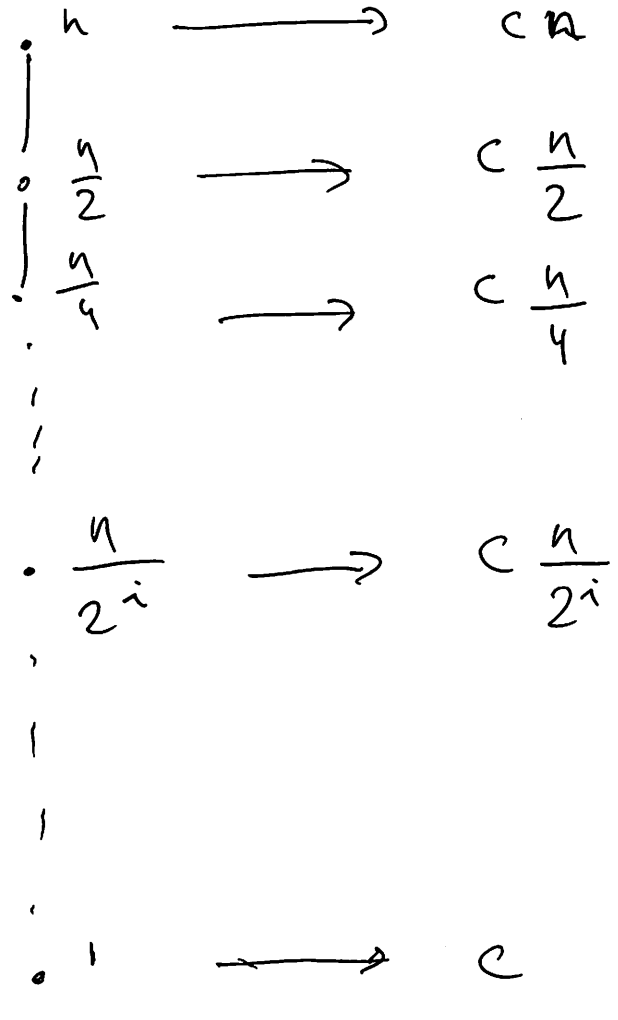


Adding up over all levels

$$c \cdot \log_2 n$$

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

$$T(n) = \begin{cases} T(n/2) + cn & n > 1 \\ c & n = 1 \end{cases}$$



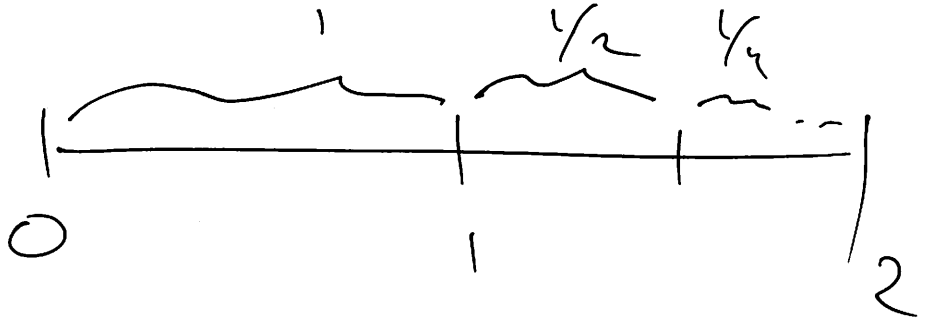
Adding up

$$\sum_{i=0}^{\log_2 n} c\frac{n}{2^i} = cn \sum_{i=0}^{\log_2 n} \frac{1}{2^i}$$

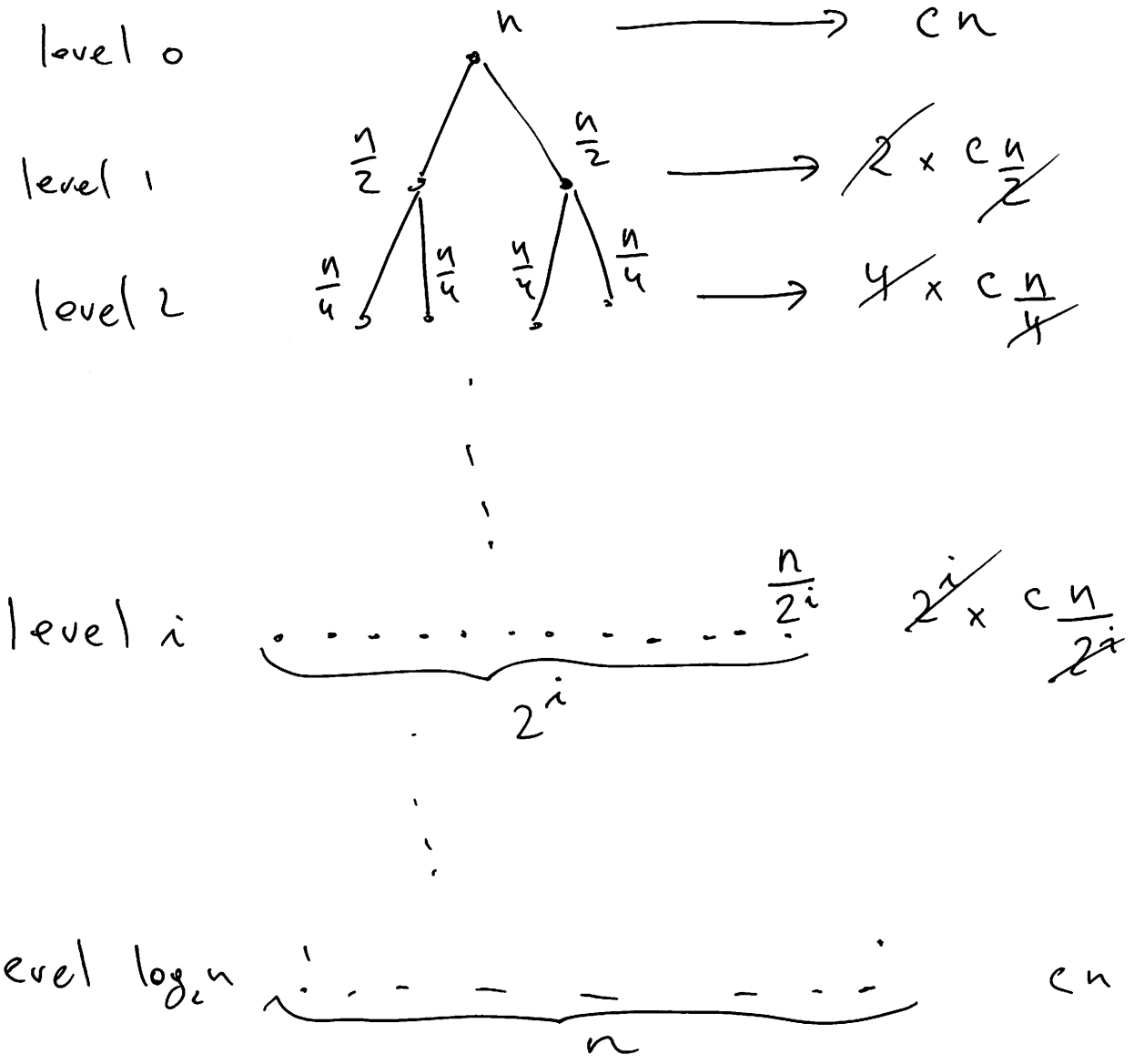
$$\leq cn \sum_{i=0}^{\infty} \frac{1}{2^i}$$

$$= 2cn$$

$$\Rightarrow T(n) = O(n)$$



$$T(n) = \begin{cases} 2\,T\left(\left\lceil \frac{n}{2} \right\rceil\right) + cn & n > 1 \\ c & n = 1 \end{cases}$$

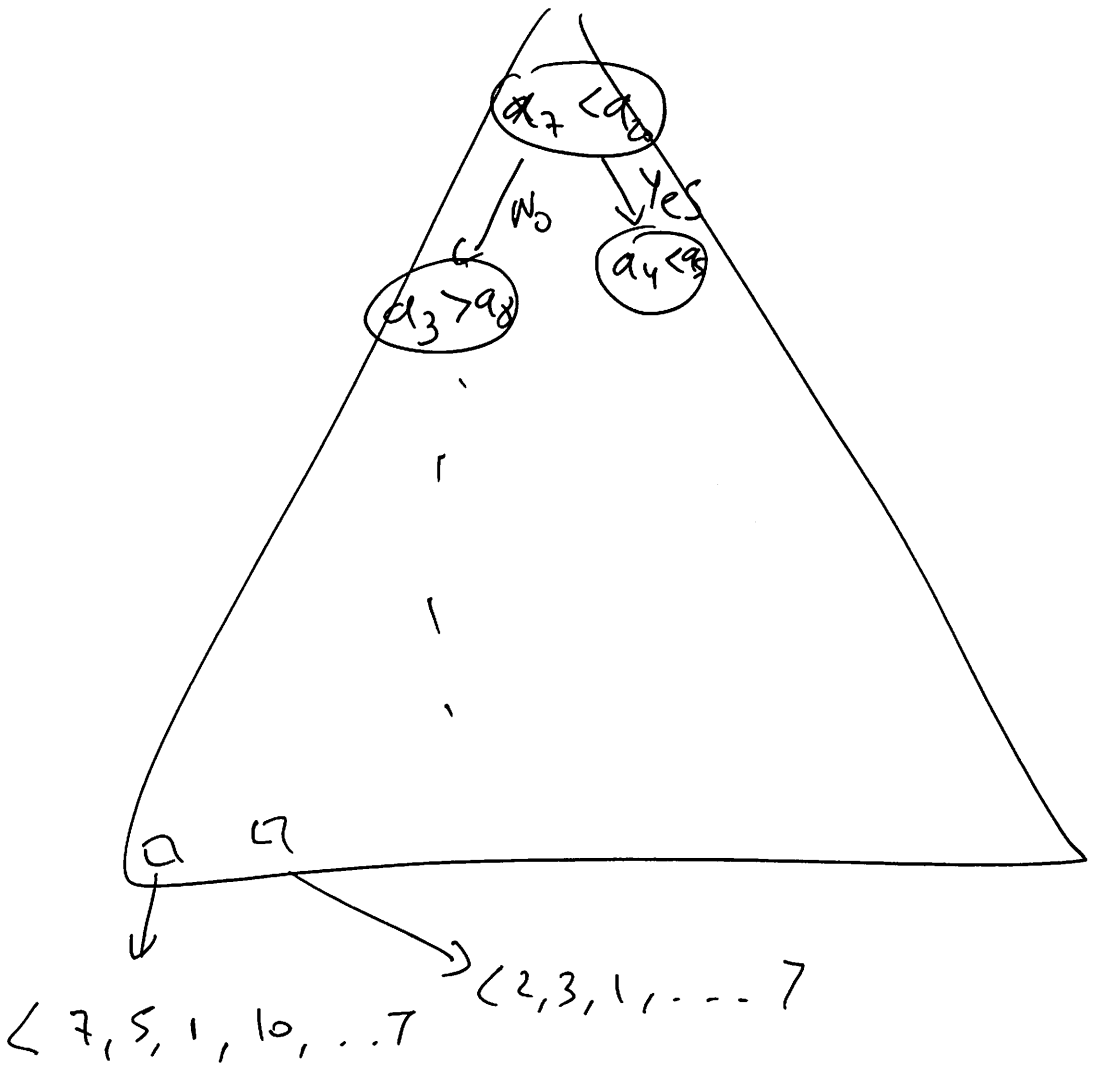


Adding up

$$cn \log_2 n$$

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

$A = \langle a_1, a_2, \ldots, a_n \rangle$



$\geq \log_2$ # leaves

$\geq \log_2 n!$

$= \Omega(n \log n)$

leaves are permutations of $\{1, \ldots, n\}$