

$$O\left(\sum_{i=0}^k 2^i \frac{n}{2^i}\right)$$

$$\begin{aligned}
 &= O_0(n) \\
 &+ \\
 &= O_1(n) \\
 &+ \\
 &= O_2(n) \\
 &+ \\
 &\dots \\
 &= O_{k=\log n}(n) \\
 &= \\
 &= O\left(\sum_{i=0}^k n\right) = O(k \cdot n) \Leftrightarrow O(n \cdot \log n)
 \end{aligned}$$