Problems Related Merge Procedure
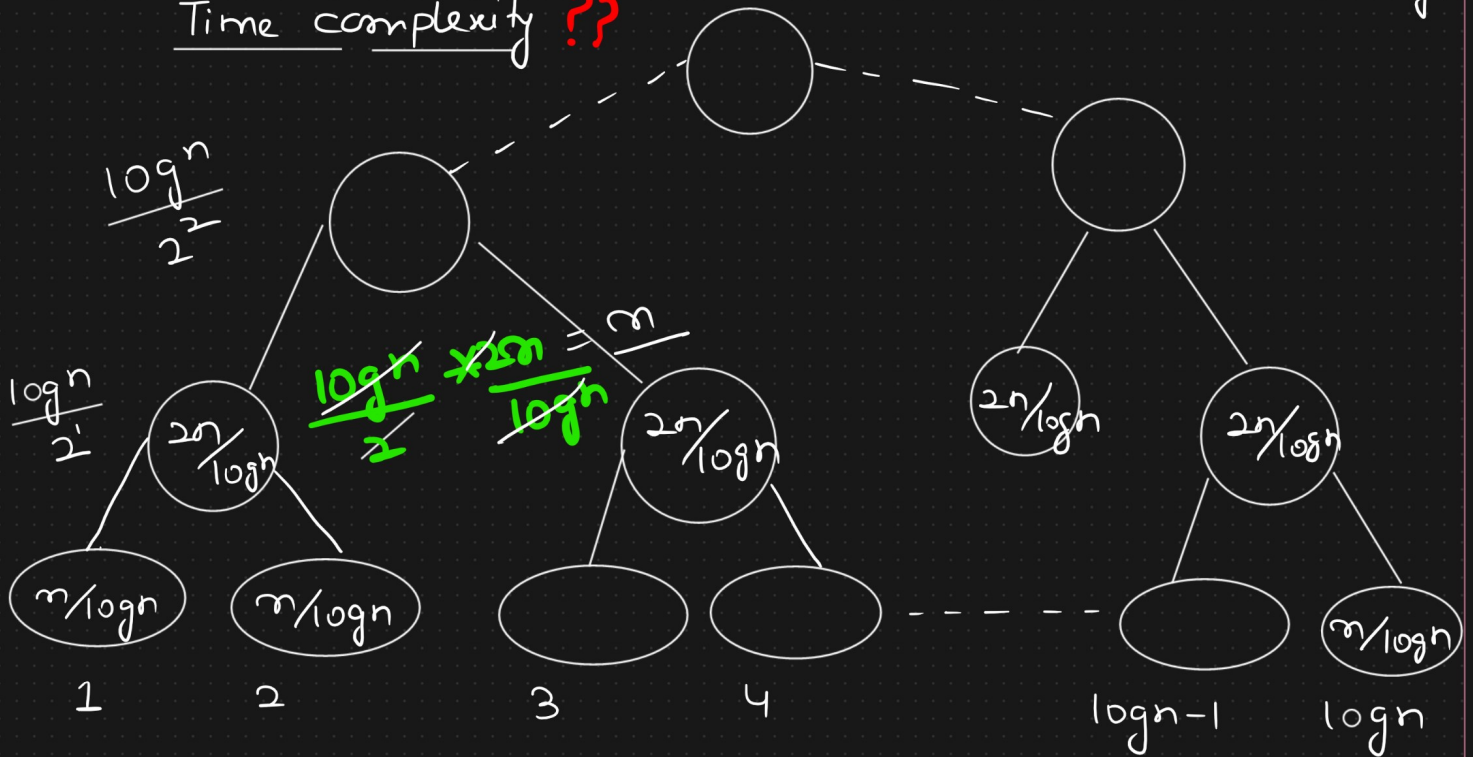
1) $\log n$ sorted subarrays & each of subarray is of size $\frac{n}{\log n}$

   Time complexity ??

$\frac{\log n}{2^2}$

$\frac{\log n}{2^1}$

$\frac{\log n}{1} \times \frac{n}{\log n} = \frac{n}{\log n}$

Tree nodes:

$\frac{2n}{\log n}$ $\frac{2n}{\log n}$ $\frac{2n}{\log n}$ $\frac{2n}{\log n}$

$\frac{n}{\log n}$ $\frac{n}{\log n}$ ... $\frac{n}{\log n}$

1   2   3   4 $\log n - 1$ $\log n$

$$\frac{n}{\log n} * \log n = n$$

$$\frac{\log n}{2^k} = 1$$

$$\log n = 2^k$$

$$\boxed{\log_2 (\log n) = k}$$

Time complexity $\Rightarrow O(n \cdot k)$

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

10 ice-creams

$$
\begin{cases}
1 \text{———} 2 \\
2 \text{——} 2 \\
3 \text{——} 2 \\
4 \text{——} 2 \\
5 \text{——} 2
\end{cases}
\begin{cases}
2+2+2+2+2=10 \\[6pt]
\underline{\underline{2*5=10}}
\end{cases}
$$

$$
\begin{cases}
1 \text{—————} 1 \\
2 \text{————} 3 \\
3 \text{———} 2 \\
4 \text{——} 7 \\
5 \text{———} 8
\end{cases}
\quad 1+3+2+7+8
$$

2) nk sorted subarray & each of size n/k

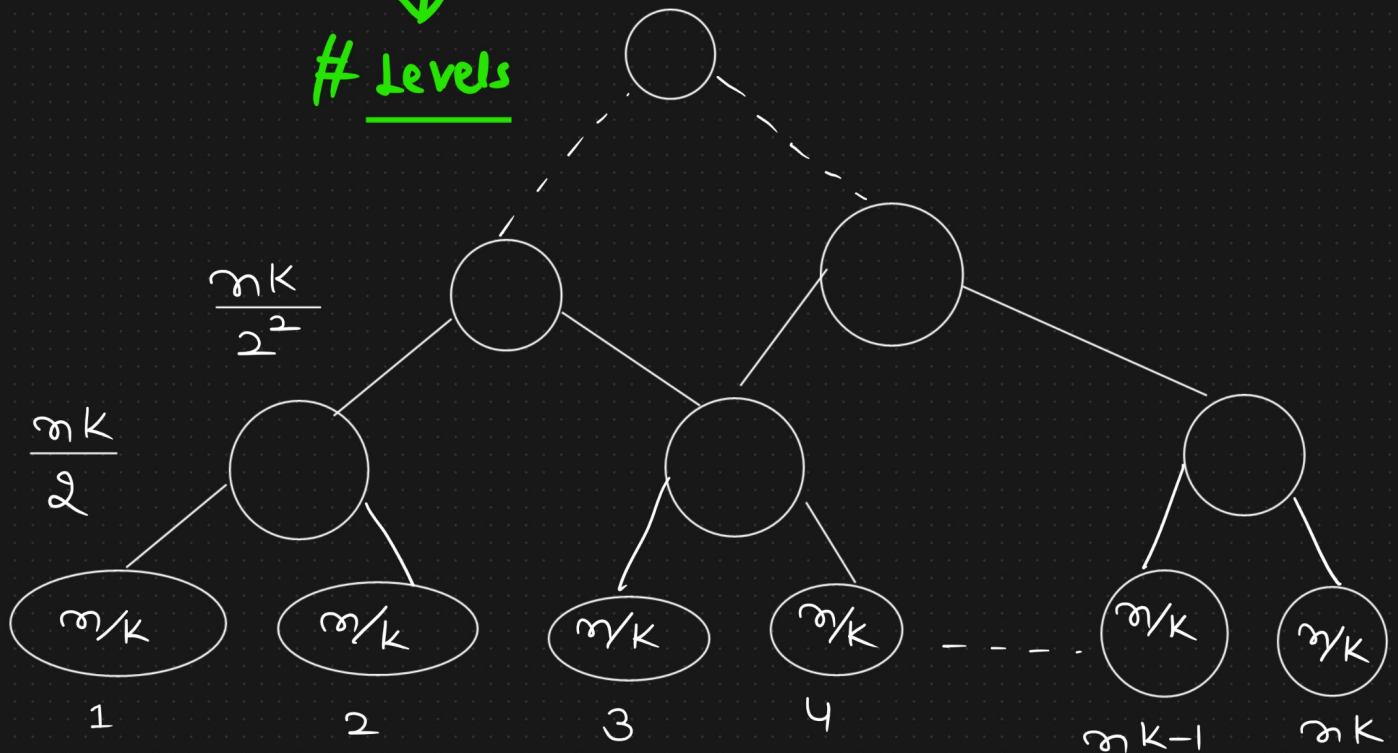$$\text{Time complexity} \rightarrow O(n^2 \cdot m)$$

$$O\left(n^2 \log_2(nk)\right)$$

$$\frac{nk}{2^m} = 1$$

$$nk = 2^m$$

$$\boxed{m = \log_2(nk)}$$

↓

Levels

$$\frac{nk}{2^2}$$

$$\frac{nk}{2}$$

n/k n/k n/k n/k - - - - n/k n/k

1   2   3   4 $nk-1$ nk

$$\frac{n}{k} * nk = n^2$$

$$\boxed{\text{Merge Procedure} \rightarrow O(n)}$$