

Induction:

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

Base: let  $n=1$

$$\begin{aligned} T(1) &= (1) \log(1) + (1) \\ &= 0 + 1 \\ &= 1 \quad \text{True} \end{aligned}$$

let  $n=2$

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

$$\begin{aligned} T(2) &= 2(1) + 2 \\ &= 2 + 2 \\ &= 4 \end{aligned}$$

Induction hypothesis:

$n$  is true for any  $k$   
prove for  $n = k+1$

$$T(k+1) = 2 T\left(\frac{k+1}{2}\right) + k+1 = (k+1) \log(k+1) + (k+1)$$