**Exercise 2.3-3:**

$$\because T(n) = \begin{cases} 2 & if\ n = 2, \\ \\ 2T(n/2) + n & if\ n = 2^k, for\ k > 1 \end{cases}$$

$\therefore When\ n = 2, T(n) = 2$

$\therefore When\ n = 4, T(n) = 2T(2) + 4$

$\therefore T(n) = n \lg n, for\ n = 2, 4$

$\therefore Suppose\ for\ k \in \{1, 2, \ldots, K\}, K \in N^*, when\ n = 2^k, T(n) = n \lg n = k2^k$

$\therefore When\ k = K + 1, n = 2^{K+1}$

$$\begin{aligned} T(n) &= T(2^{K+1}) \\ &= 2T(2^K) + 2^{K+1} \\ &= 2K2^K + 2^{K+1} \\ &= (K+1)2^{K+1} \\ &= n \lg n \end{aligned}$$

$\therefore It\ holds\ for\ k = K + 1$

$\therefore T(n) = n \lg n$