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

$$\begin{aligned}
T(n) &= 2T(\frac{n}{2}) + n \\
and & \\
T(\frac{n}{2}) = 2T(\frac{n}{4}) + \frac{n}{2} &\Rightarrow T(n) = 4T(\frac{n}{4}) + 2n \\
Knowing & \\
T(n/4) = 2T(\frac{n}{8}) + \frac{n}{4} &\Rightarrow T(n) = 8T(\frac{n}{8}) + 3n \\
\cdots & \\
&\Rightarrow T(n) = 2^i T(\frac{n}{2^i}) + in \\
We\ have: & \\
T(n/2^i) = 2 &\Leftrightarrow \frac{n}{2^i} = 2 \\
\frac{n}{2^i} = 2 &\Leftrightarrow i + 1 = \frac{lg_2(n)}{lg_2(2)} \\
Therfore & \\
T(n) = 2^{lg_2(n)} + (lg_2(n) - 1)n &\Leftrightarrow T(n) = n(1 - 1 + lg_2(n)) \\
&\Leftrightarrow T(n) = nlg_2(n)
\end{aligned}$$