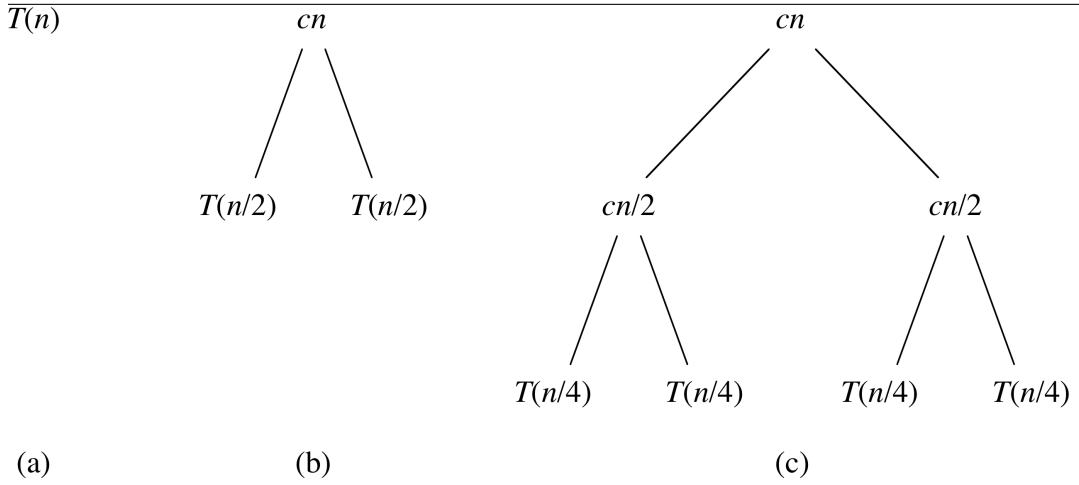
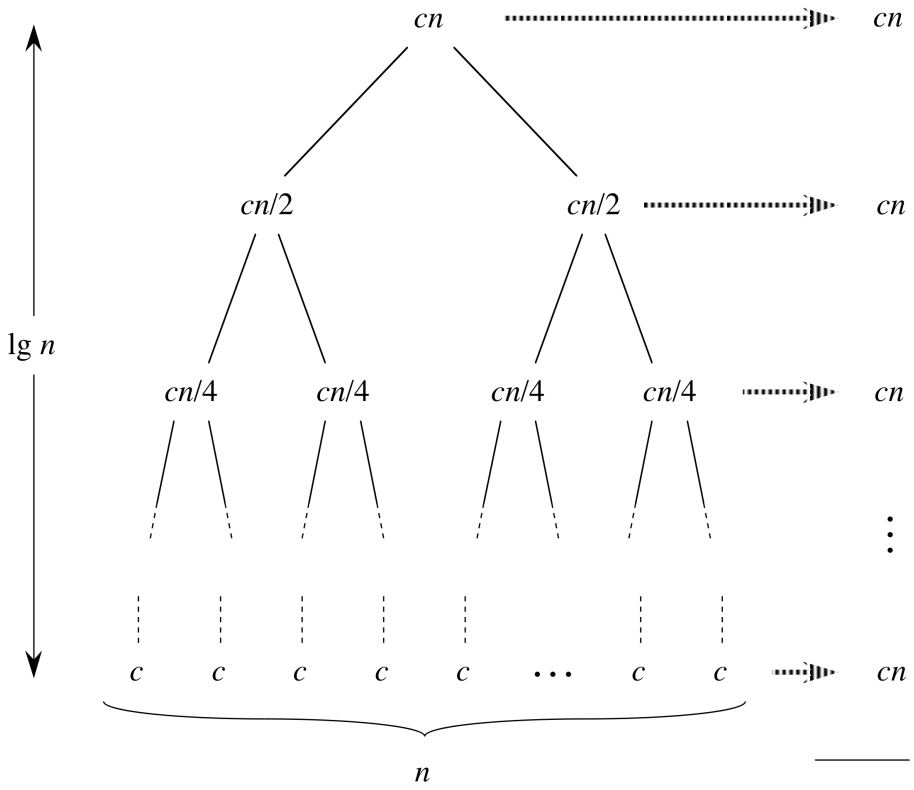
$$T(n) = 2T(n/2) + cn$$



(a) (b) (c)



(d)

Total: $cn \lg n + cn$

Subarray (and Mergesort) Recurrence

$$T(1) = c$$
$$T(n) = 2T(n/2) + cn$$

$$\begin{aligned}
T(n) &= \cancel{2T(n/2)} + cn \\
\cancel{2T(n/2)} &= \cancel{2^2 T(n/2^2)} + 2cn/2 \\
\cancel{2^2 T(n/2^2)} &= \cancel{2^3 T(n/2^3)} + 2^2 cn/2^2 \\
\cancel{2^3 T(n/2^3)} &= \cancel{2^4 T(n/2^4)} + 2^3 cn/2^3 \\
&\cdots \\
\cancel{2^{\lg n-1} T(n/2^{\lg n-1})} &= 2^{\lg n} T(1) + 2^{\lg n-1} cn/2^{\lg n-1}
\end{aligned}$$

$$\begin{aligned}
T(n) &= c2^{\lg n} + \sum_{i=0}^{\lg n-1} cn \\
&= cn + cn \lg n \\
&= \Theta(n \lg n)
\end{aligned}$$