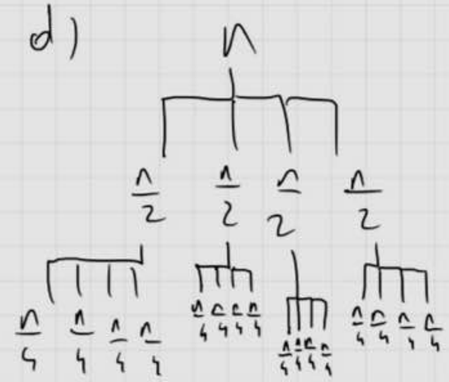
Ex 5.2

a) $O(n^2)$

c) $T(n) = 4T(n/2) + n$

d)



Sum

$2^1 n$

$2^2 n$

$2^3 n$

$\vdots$

$2^i n$

height $= \log_2 n$

$$T(n) = 4^h T(1) + \sum_{i=0}^{h-1} 2^i n$$

$$T(n) = 4^{\log_2 n} T(1) \sum_{i=0}^{h-1} 2^i n$$

$$T(n) = n^{\log_2 4} T(1) \sum_{i=0}^{h-1} 2^i n$$

$$T(n) = n^2 T(1) + n[1 + 2 + 2^2 \dots + 2^{h-1}]$$

$$\frac{1(2^h - 1)}{2-1} = 2^h - 1 = 2^{\log_2 n} - 1 = n - 1$$

$$T(n) = n^2 + T(1) + n(n-1) \Rightarrow T(n) = \Theta(n^2)$$

e) $T(n) = 4T(n/2) + n$

$n^{\log_b a} = n^2 > f(n) = n$

$f(n) = O(n^{2-\varepsilon})$ for $\varepsilon = 1$

Thus, $\Theta(n^2)$