

Recurrence Relation

is Quasilinear

$$T(1) = 1$$

$$T(N) = 1 + T(N/2) + T(N/2) + T(N/2) + T(N/2) \\ = 1 + 4T(N/2)$$

$$= 1 + 4[1 + 4T(N/2^2)]$$

$$= 1 + 4 + 4^2T(N/2^2)$$

$$= 1 + 4 + 4^2[1 + 4T(N/2^3)]$$

$$= 1 + 4 + 4^2 + 4^3T(N/2^3)$$

$$= \sum_{j=0}^{k-1} 4^j + 4^k T(N/2^k)$$

$$2^k = N \\ k = \lg N$$

$$= \frac{4^k - 1}{4 - 1} + 4^{\lg N} T(N/N)$$

$$= \frac{2^{2 \lg N} - 1}{3} + 2^{2 \lg N}$$

$$= 2^{\lg N^2} + 2^{\lg N^2} = N^2 + N^2 = O(N^2)$$