Binary Search

$$T(N) = C + T(N/2)$$

$$T(N) = C + T(N/4)$$

subtract

$$T(N) = T(N/4) + 2C$$

$$T(N/4) = C + T(N/8)$$

subtract

$$T(N) = T(N/8) + 3C$$

Pattern

$$T(N) = T(N/2^i) + iC$$

$$T(N/2^i) = T(1)$$

$$N/2^i = 1 \quad \rightarrow \quad N = 2^i$$

$$\log N = \log 2^i$$

$$\log N = i$$

$$T(N) = T\left(N/2\log N\right) + C \log N$$

$$= T\left(N/N'\right) + C \log N$$

$$= T(1) + C \log N$$

$$= K + C \log N$$

$$T(N) = O(\log N)$$