

$$T(n) = \begin{cases} 1 & \text{si } n = 1 \\ 3T\left(\frac{n}{2}\right) + n^2 & \text{si } n \neq 1 \end{cases}$$

$$\sum_{i=a}^b x^i = \frac{x^{b+1} - x^a}{x - 1}$$

$$T(n) = 3 \cdot T\left(\frac{n}{2}\right) + n^2 \quad k = 1$$

$$T(n) = 3 \cdot \left[3 \cdot T\left(\frac{n}{2}\right) + \left(\frac{n}{2}\right)^2 \right] + n^2 = 9 \cdot T\left(\frac{n}{4}\right) + 3 \cdot \frac{n^2}{4} + n^2 = 9 \cdot T\left(\frac{n}{4}\right) + \frac{3}{4} \cdot n^2 + n^2 \quad k = 2$$

$$T(n) = 9 \cdot \left[3 \cdot T\left(\frac{n}{4}\right) + \left(\frac{n}{4}\right)^2 \right] + 3 \cdot \frac{n^2}{4} + n^2 = 27 \cdot T\left(\frac{n}{8}\right) + 9 \cdot \frac{n^2}{16} + 3 \cdot \frac{n^2}{4} + n^2 = 27 \cdot T\left(\frac{n}{8}\right) + \frac{9}{16} \cdot n^2 + \frac{3}{4} \cdot n^2 + n^2 \quad k = 3$$

$$T(n) = 27 \cdot \left[3 \cdot T\left(\frac{n}{8}\right) + \left(\frac{n}{8}\right)^2 \right] + 9 \cdot \frac{n^2}{16} + 3 \cdot \frac{n^2}{4} + n^2 = 81 \cdot T\left(\frac{n}{16}\right) + 27 \cdot \frac{n^2}{64} + 9 \cdot \frac{n^2}{16} + 3 \cdot \frac{n^2}{4} + n^2 = 81 \cdot T\left(\frac{n}{16}\right) + \frac{27}{64} \cdot n^2 + \frac{9}{16} \cdot n^2 + \frac{3}{4} \cdot n^2 + n^2 \quad k = 4$$

$$T(n) = 3^k \cdot T\left(\frac{n}{2^k}\right) + \sum_{i=0}^{k-1} \left(\frac{3}{4}\right)^i \cdot n^2 \quad \text{Como } T(1) = 1 \Rightarrow \frac{n}{2^k} = 1 \Rightarrow n = 2^k \Rightarrow \log_2 n = k$$

$$T(n) = 3^{\log_2 n} \cdot T\left(\frac{n}{2^{\log_2 n}}\right) + \sum_{i=0}^{\log_2 n - 1} \left(\frac{3}{4}\right)^i \cdot n^2 = n^{\log_2 3} \cdot T\left(\frac{n}{n}\right) + n^2 \cdot \left[\frac{\left(\frac{3}{4}\right)^{\log_2 n} - 1}{\frac{3}{4} - 1} \right] = n^{\log_2 3} \cdot T(1) + n^2 \cdot \left(\frac{n^{\log_2 \frac{3}{4}} - 1}{-\frac{1}{4}} \right)$$

$$T(n) = n^{\log_2 3} \cdot T(1) - n^2 \cdot \left(\frac{n^{\log_2 \frac{3}{4}} - 1}{\frac{1}{4}} \right) = n^{\log_2 3} \cdot 1 - 4 \cdot n^2 \cdot \left(n^{\log_2 \frac{3}{4}} - 1 \right) = n^{\log_2 3} - 4 \cdot n^2 \cdot \left(n^{\log_2 3 - \log_2 4} - 1 \right)$$

$$T(n) = n^{\log_2 3} - 4 \cdot n^2 \cdot \left(n^{\log_2 3} \cdot n^{-\log_2 4} - 1 \right) = n^{\log_2 3} - 4 \cdot n^2 \cdot \left(\frac{n^{\log_2 3}}{n^{\log_2 4}} - 1 \right) = n^{\log_2 3} - 4 \cdot n^2 \cdot \left(\frac{n^{\log_2 3}}{n^2} - 1 \right)$$

$$T(n) = n^{\log_2 3} - 4 \cdot n^2 \cdot \left(\frac{n^{\log_2 3} - n^2}{n^2} \right) = n^{\log_2 3} - 4 \cdot \left(n^{\log_2 3} - n^2 \right) = n^{\log_2 3} - 4 \cdot n^{\log_2 3} + 4 \cdot n^2 = -3 \cdot n^{\log_2 3} + 4 \cdot n^2$$

$$T(n) = 4n^2 - 3n^{\log_2 3}$$

$$T(n) \in O(n^2)$$