

$$206/ \quad T(n) = \begin{cases} 1 & , n=1 \\ 2T(n-1) + n-1 & , n \geq 2 \end{cases}$$

$$T(n) = 2T(n-1) + n-1$$

$$= 2(2T(n-2) + n-2) + n-1$$

$$= 2^2 T(n-2) + 2(n-2) + n-1$$

=

$$= 2T(n-n+1) + 2(1 + \dots + n-2) + n-1$$

$$= 2^n + 2 \cdot \frac{(n-1)(n-2)}{2} + n-1$$

$$= 2^n + n^2 - 3n + 2 + n - 1 = 2^n + n^2 - 2n + 1$$

$$= O(2^n)$$

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$$2, \text{ 205/ } T(n) = \begin{cases} 3 & \text{if } n=1 \\ T(n-1) + 2n-3 & \text{if } n \geq 2 \end{cases}$$

$$T_5(n) = T(n-1) + 2n-3$$

$$\begin{aligned} &= \cancel{T(n-2)} + 2(n-1) - 3 = T(n-2) + 2n - 5 \\ &= \cancel{T(n-2)} + 2n - 3 + 2(n-1) - 3 \\ &= T(n-1) + 2(n-1) - 1 \\ &= T(n-2) + 2(n-1) + 2(n-2) - 2 \\ &= \dots \\ &= T(n-n+1) + 2(1+2+\dots+n-1) - n \\ &= 3 + n(n-1) - n + 1 \\ &= n^2 + 2n + 4 \\ &= O(n^2) \end{aligned}$$

$$208/ \quad T(n) = \begin{cases} 1 & \text{if } n=1 \\ 2T(n/2) + 6n-1 & \text{if } n \geq 2 \end{cases}$$

$$n = 2^m$$

$$\begin{aligned} T(2^m) &= 2 \cdot T(2^{m-1}) + 6 \cdot 2^m - 1 \\ &= 4T(2^{m-2}) + 2(6 \cdot 2^{m-1} - 1) + 6 \cdot 2^m - 1 \\ &= 4T(2^{m-2}) + 6 \cdot 2^m - 2 + 6 \cdot 2^m - 1 \end{aligned}$$

$$\begin{aligned} &= n \cdot 6 \cdot 2^m + (-1-2-\dots-n) \\ &= n \cdot 6 \cdot 2^m - \frac{\log(n) \cdot \log(n-1)}{2} \end{aligned}$$

$$\begin{aligned} &= n \cdot 6 \cdot n - \frac{\log(n) \cdot \log(n-1)}{2} \\ &= 6n^2 - \frac{\log(n)^2 \log(n-1)}{2} \\ &= \cancel{O(n^2)} O(n \log n) \end{aligned}$$

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