

# Another Unrolling Example

Note Title

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## QuickSort Worst Case

$$T(n) = T(n-1) + \Theta(n)$$

$$T(n-1) = T(n-2) + \Theta(n-1) \quad \text{from defn}$$

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

$$T(n-2) = T(n-3) + \Theta(n-2) \quad \text{from defn}$$

$$T(n) = T(n-3) + \overset{\in \Theta(n)}{\Theta(n-2)} + \overset{\in \Theta(n)}{\Theta(n-1)} + \Theta(n)$$

Notice pattern:

$$T(n) = \underbrace{T(1)}_{\emptyset} + \underbrace{\Theta(n) + \Theta(n) + \dots + \Theta(n)}_{(n-1) \text{ terms}}$$

$$\begin{aligned} T(n) &= \sum_{i=1}^{n-1} c \cdot n = c \sum_{i=1}^{n-1} n = c(n-1) \cdot n \\ &= cn^2 - cn \\ &= \Theta(n^2) \end{aligned}$$