

$$T(1) = \Theta(1)$$

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

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

$$= T(n-2) + \left((n-1)^2 + n^2 \right) - \left((n-1) + n \right)$$

$$= T(n-k) + \sum_{i=n-k+1}^n i^2 - \sum_{i=n-k+1}^n i$$

$$T(n-k) = T(1) \text{ when } n=k+1$$

$$\Rightarrow T(n) = T(1) + \sum_{i=2}^n i^2 - \sum_{i=2}^n i$$

$$= \Theta(1) + \left(\sum_{i=1}^n i^2 - 1 \right) - \left(\sum_{i=1}^n i - 1 \right)$$

$$= \Theta(1) + \sum_{i=1}^n i^2 - \sum_{i=1}^n i$$

$$= \Theta(1) + \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)}{2}$$

$$= \Theta(1) + \Theta(n^3) - \Theta(n^2)$$

$$\Rightarrow T(n) = \Theta(n^3)$$