



# Calculating expectation

$$\begin{aligned} E[T(n)] &= E\left[\sum_{k=0}^{n-1} X_k (T(k) + T(n-k-1) + \Theta(n))\right] \\ &= \sum_{k=0}^{n-1} E[X_k (T(k) + T(n-k-1) + \Theta(n))] \\ &= \sum_{k=0}^{n-1} E[X_k] \cdot E[T(k) + T(n-k-1) + \Theta(n)] \\ &= \frac{1}{n} \sum_{k=0}^{n-1} E[T(k)] + \frac{1}{n} \sum_{k=0}^{n-1} E[T(n-k-1)] + \frac{1}{n} \sum_{k=0}^{n-1} \Theta(n) \\ &= \frac{2}{n} \sum_{k=1}^{n-1} E[T(k)] + \Theta(n) \end{aligned}$$

Summations have identical terms.