Worst case $T(n) = T(n-1) + cn$

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

$= T(n-3) + c(n-2) + c(n-1) + cn$

$\cdots\cdots$

$= (c + 2c + 3c + \cdots + c(n-1) + cn)$

$= c(1+2+3+\cdots+n)$

$= c\,\frac{n(n+1)}{2} = \Theta(n^2)$

Best case $T(n) = T(n/2) + T(n-1-\frac{n}{2}) + cn$

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

$= T(n/2) + T(n/2) + cn$

According to master theorem, $a = 2$ $b=2$. $d=1$ $\Rightarrow \Theta(n\lg n)$

Average case $T(n) = T(n-k) + T(k)$

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

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

$nT(n) = 2\sum_{i=1}^{n-1} T(i)$ ①

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

① - ② $nT(n) - (n-1)T(n-1) = 2T(n-1) + cn^2 - c(n-1)^2$

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

$\frac{T(n)}{n+1} = \frac{T(n-1)}{n} + \frac{2c}{n+1}$

$\frac{T(n-1)}{n} = \frac{T(n-2)}{n-1} + \frac{2c}{n}$

$\frac{T(n)}{n+1} = \frac{T(n-2)}{n-1} + \frac{2c}{n+1} + \frac{2c}{n}$

$\frac{T(n-2)}{n-1} = \frac{T(n-3)}{n-2} + \frac{2c}{n-1}$

$\vdots$

$\frac{T(n)}{n+1} = \frac{T(1)}{2} + 2c\left[\frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n} + \frac{1}{n+1}\right]$

$T(n) = 2c\log_2 n(n+1)$ $\Theta(n\log_2 n)$