Exercise 1 (10 pt)
Solve the following recurrence using the Master theorem and the Recursion-tree method. Provide a detailed explanation of the application of each method.

\[
T(n) = \begin{cases} 
5T\left(\frac{n}{4}\right) + \Theta(n) & \text{if } n > 1 \\
\Theta(1) & \text{if } n = 1
\end{cases}
\]
Exercise 2 (10pt)
Provide a description of the Quicksort algorithm and the pseudo code. Derive the general recurrence equation of its complexity and discuss best and worst case. It is not necessary to solve the recurrences.
Exercise 3 (10pt)
An array \( V \) of \( n \geq 2 \) integer numbers is continuous if \( |V[i + 1] - V[i]| \leq 1, \forall i = 1,..,n-1 \). A zero of \( V \) is an index \( k \) such that \( V[k] = 0 \).

Design an algorithm that given a continuous array \( V \), such that \( n \geq 2 \), \( V[1] \leq 0 \) and \( V[n] \geq 0 \), finds a zero in \( \Theta(\log(n)) \) time. Give the pseudo code of the algorithm, derive the recurrence equation and solve it with one method.