

Design and Analysis of Algorithms

CSE 5311 - 005

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2.1-1) $A = \{13, 19, 9, 5, 12, 8, 7, 4, 21, 2, 6, 11\}$

choosing last element as pivot element = 11

step-by-step description of partition function call-

$A = \{13, 19, 9, 5, 12, 8, 7, 4, 21, 2, 6, 11\}$

$\begin{array}{c} p_i \quad j \\ |13| 19 \quad 9 \quad 5 \quad 12 \quad 8 \quad 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \quad i \quad j \\ |13 \quad 19| 9 \quad 5 \quad 12 \quad 8 \quad 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p_i \quad j \\ 9 | 13 \quad 19 | 5 \quad 12 \quad 8 \quad 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

9

$\begin{array}{c} p \quad i \\ 9 \quad 5 \end{array}$

$\begin{array}{c} j \\ 9 \quad 5 | 13 \quad 19 | 12 \quad 8 \quad 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \quad i \quad j \\ 9 \quad 5 | 13 \quad 19 \quad 12 | 8 \quad 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \quad i \quad j \\ 9 \quad 5 \quad 8 | 13 \quad 19 \quad 12 | 7 \quad 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \quad i \quad j \\ 9 \quad 5 \quad 8 \quad 7 | 13 \quad 19 \quad 12 | 4 \quad 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \quad i \quad j \\ 9 \quad 5 \quad 8 \quad 7 \quad 4 | 13 \quad 19 \quad 12 | 21 \quad 2 \quad 6 | 11 \end{array}$

$\begin{array}{c} p \\ |9 \quad 5 \quad 8 \quad 7 \quad 4| \end{array}$

(next ps.)

$$\begin{array}{ccccccc|cccc|cc|c} & p & & & i & & & & & j & & r \\ 9 & 5 & 8 & 7 & 4 & & 13 & 19 & 12 & 21 & & 2 & 6 & 11 \end{array}$$

$$\begin{array}{ccccccc|cccc|c|c} & p & & & i & & & & & j & & r \\ 9 & 5 & 8 & 7 & 4 & 2 & 13 & 19 & 12 & 21 & 6 & 11 \end{array}$$

$$\begin{array}{ccccccc|cccc|c} & p & & & i & & & & & j & & r \\ 9 & 5 & 8 & 7 & 4 & 2 & 6 & 13 & 19 & 12 & 21 & 11 \end{array}$$

$$A = \left\{ \begin{array}{ccccccc|cc|cccc|c} & p & & & i & & & & & j & & r \\ 9 & 5 & 8 & 7 & 4 & 2 & 6 & 11 & 7 & 5 & 6 & 8 & 11 \end{array} \right\}$$

7.2-2) The runtime complexity for Quicksort in this case would be $O(n^2)$, which is the worst case possibility for Quicksort.

This occurs because the algorithm fails to divide the problem into smaller subproblems, instead it only reduces the problem size by 1 in each recursive step, leading to linear recursion depth and quadratic overall time complexity.