Q.13

Time taken by Quicksort can be written as following.

$$T(n) = T(k) + T(n-k-1) + \theta(n)$$

The worst case occurs when the partition process always picks greatest or smallest element as pivot. If we consider above partition strategy where last element is always picked as pivot, the worst case would occur when the array is already sorted in increasing or decreasing order. Following is recurrence for worst case. Recurrence occur 2 time.

Here k is 0. So,
$T(n) = T(0) + T(n-1) + \theta(n)$
$T(n) = T(n-1) + \theta(n)$
So, the solution of above recurrence is **$\theta(n^2)$**

Q.17

Expression	Dominant term(s)	O(...)
$5 + 0.001n^3 + 0.025n$	$0.001n^3$	$O(n^3)$
$500n + 100n^{1.5} + 50n \log_{10}n$	$100n^{1.5}$	$O(n^{1.5})$
$0.3n + 5n^{1.5} + 2.5\ n^{1.75}$	$2.5\ n^{1.75}$	$O(n^{1.5})$
$n^2 \log_2 n + n(\log_2 n)^2$	$n^2 \log_2 n$	$O(n^2 \log n)$
$n \log_3 n + n \log_2 n$	$n \log_3 n$, $n \log_2 n$	$O(n \log n)$
$3 \log_8 n + \log_2 \log_2 \log_2 n$	$3 \log_8 n$	$O(\log n)$
$100n + 0.01n\ 2$	$0.01n\ 2$	$O(n^2)$
$0.01n + 100n^2$	$100n^2$	$O(n^2)$
$2n + n^{0.5} + 0.5n^{1.25}$	$0.5n^{1.25}$	$O(n^{1.25})$
$0.01n \log_2 n + n(\log_2 n)^2$	$n(\log_2 n)^2$	$O(n (\log n)^2)$
$100n \log_3 n + n^3 + 100n$	n^3	$O(n^3)$
$0.003 \log_4 n + \log_2 \log_2 n$	$0.003 \log_4 n$	$O(\log n)$

Q.28

Time taken by Bubble sort can be written as following.

$$T(n) = T(k) + T(n-k-1) + \theta(n)$$

The worst case occurs when the partition process always picks greatest element. If we consider above partition strategy where last element is always picked as pivot, Worst case occurs when array is reverse sorted. Following is recurrence for worst case. Recurrence occur 2 time.

Here k is 0. So,
$T(n) = T(0) + T(n-1) + \theta(n)$
$T(n) = T(n-1) + \theta(n)$
So, the solution of above recurrence is $\boldsymbol{\theta(n^2)}$

Q.29

Linear search performs equality comparisons. And Linear search does the sequential access, where data is not needed to sort. So,

Time complexity of linear search -**O(n)**