

Question - 1
Question 1**SCORE: 5 points**

What is the maximum number of times during the execution of quicksort that the largest item can be exchanged in an array of length N ?

- ☐ 1
- ☐ $\frac{1}{2}N$
- ☒ $N - 1$
- ☐ N^2

Question - 2
Question 2**SCORE: 5 points**

Given two arrays of equal length, where A1 is the array [1, 2, 3, 4, 5] and A2 is [4, 1, 5, 3, 2], which is true about the number of comparisons performed during quicksort if the shuffle step is omitted? Let C1 be the number of comparisons performed in sorting A1, and C2 be the number of comparisons performed in sorting A2.

- ☐ $C1 = C2$
- ☒ $C1 > C2$
- ☐ $C1 < C2$

Question - 3
Question 3**SCORE: 5 points**

When sorting an array of integers with quicksort, after completing the partition the array is [2, 5, 1, 8, 9, 12, 11, 10]. Which statement is correct?

- ☒ The pivot could have been either 8 or 9
- ☐ The pivot was 8, it could not have been 9
- ☐ The pivot was 9, it could not have been 8
- ☐ The pivot could not have been 8 or 9

Question - 4
Question 4

SCORE: 5 points

For the Quicksort algorithm suppose there is a procedure for finding a pivot element which splits the list into two sub-lists each of which contains at least one-third of the elements. Let $T(n)$ be the number of comparisons required to sort n elements. Which one is correct?

- ☒ $T(n) \leq T(n/3) + T(2n/3) + n$
- ☐ $T(n) \geq T(n/3) + T(2n/3) + n$
- ☐ $T(n) \leq 2T(n/3) + n$
- ☐ $T(n) \geq 2T(n/3) + n$

Question - 5
Question 5

SCORE: 5 points

Suppose quicksort is implemented for an array of N elements by always choosing the middle element of the array as the pivot. The tightest upper bound for the worst-case performance is:

- ☐ $O(N \log N)$
- ☒ $O(N^2)$
- ☐ $O(N^3)$
- ☐ $O(N^{3/2})$

Question - 6
Question 6

SCORE: 5 points

In an array representation of a binary heap, what is the index of the 4th item in the array, and what are the indexes of its children?

- ☐ 3, 4, 5
- ☐ 3, 6, 7
- ☐ 4, 5, 6
- ☒ 4, 8, 9

Question - 7
Question 7

SCORE: 5 points

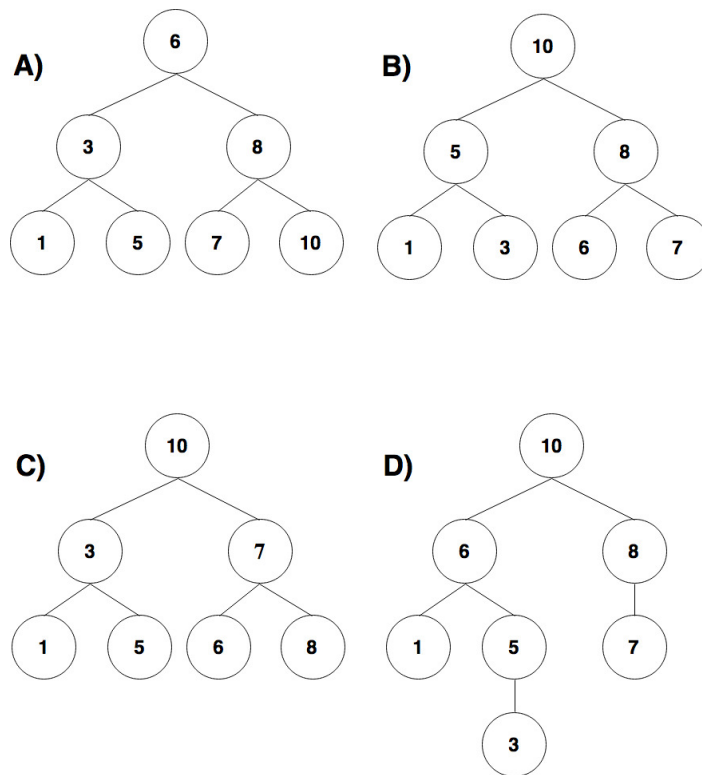
When inserting a new item to a binary heap, what is the maximum number of compares performed?

- ☐ 1
- ☐ $\lg N$
- ☐ $N \lg N$
- ☒ $\lg N + 1$

Question - 8
Question 8

SCORE: 5 points

Which of the following is a maximum-oriented binary heap?



- ☐ A
- ☒ B
- ☐ C
- ☐ D