Quiz 7

The Art of Computer Programming

8 December 2025

Full name: .....

You have 10 minutes to answer this quiz, directly on this sheet of paper. No electronic devices or material of any kind is allowed. Do not forget to add your name above. Every question amounts to 2 points; the quiz is graded out of 10 points.

Questions

Q1. Circle the correct statement about **sorting algorithms**:

a. Sorting always takes $\Theta(n \log n)$ time, no matter the algorithm.

b. The goal of sorting is to rearrange elements into an order consistent with a given comparison.

c. Sorting algorithms can only work on integers.

d. Sorting can only be implemented using recursion.

Q2. Circle the correct statement about **insertion sort**:

a. Its worst-case time complexity is $\Theta(n \log n)$.

b. It compares each new element to those already sorted.

c. It cannot sort an array that is initially in reverse order.

d. It is faster than merge sort on large random datasets.

Q3. Circle the correct statement about **merge sort**:

a. Its worst-case time complexity is $\Theta(n^2)$.

b. It is based on the divide-and-conquer paradigm.

c. It sorts by repeatedly swapping adjacent elements.

d. It avoids additional memory usage entirely.

Q4. Circle the correct statement about **quick sort**:

a. Its worst case occurs when the pivot splits the array evenly.

b. Choosing pivots randomly can improve performance in practice.

c. It cannot be implemented using recursion.

d. Its best-case complexity is $\Theta(n^2)$.

Q5. Circle the correct statement about **sorting lower bounds and non-comparison sorts**:

a. Any comparison-based sorting algorithm must perform at least $\Omega(n \log n)$ comparisons in the worst case.

b. Counting sort does not require assumptions on the range of input values.

c. Bucket sort is always $\Theta(n \log n)$.

d. Counting sort compares elements to determine their order.