

## Technical Writing and Problem Solving

Q1: Explain the difference between a stack and a queue, including real-world examples of where each is used.

A stack is a data structure that follows the Last-In-First-Out (LIFO) principle, meaning the last item added to the stack is the first one to be removed. Think of a stack of plates in a cafeteria: the plate placed last on top is the first to be taken off. Stacks are used in various applications like undo functionality in text editors, parsing expressions, and backtracking algorithms.

A queue, on the other hand, follows the First-In-First-Out (FIFO) principle, meaning the first item added is the first one to be removed. It resembles a line at a ticket counter: the first person in line is the first to get served. Queues are used in real-world scenarios like printer job scheduling, call center systems, and task scheduling in operating systems.

Q2: Describe the steps of a sorting algorithm you know (e.g., Bubble Sort, Merge Sort) in detail and explain why sorting is important in computer science.

Merge Sort is a divide-and-conquer algorithm used for sorting. Here are its steps:

1. Divide: Split the array into two halves until each subarray contains a single element or no elements.
2. Conquer: Recursively sort each half.
3. Combine: Merge the sorted halves back together into a single sorted array.

For example, to sort [38, 27, 43, 3, 9, 82, 10]:

- Divide it into [38, 27, 43, 3] and [9, 82, 10], then further divide.
- Sort individual arrays, e.g., [38], [27], etc.

- Merge them: [27, 38], then merge into [27, 38, 43, 3], and so on until the entire array is sorted.

Sorting is essential in computer science because it optimizes data processing, makes searching faster, and organizes data efficiently. It is a fundamental operation in databases, search engines, and data analysis.