

DSA Tutorial

Queues

Theory

Discuss the FIFO (First In, First Out) property of queues and the different Abstract Data Type (ADT) methods along with their time complexity:

- **enqueue(x)**: Add an element to the rear of the queue.
- **dequeue()**: Remove the element at the front of the queue.
- **front()**: Retrieve the element at the front of the queue without removing it.
- **isEmpty()**: Check if the queue is empty.

Key Discussion Points:

- Queues are often implemented as arrays or linked lists.
- Time complexities for enqueue and dequeue:
 - Array-based queue: **$O(1)$** for enqueue (if space available), **$O(n)$** for dequeue (if shifting elements).
 - Circular array or linked list: **$O(1)$** for both operations.

Questions

1. Find the first Unique Character in a String.
2. Design a stack using two queues. Implement the following operations:
 - **push(x)**: Push an element onto the stack.
 - **pop()**: Remove the element on top of the stack.
 - **top()**: Get the top element.
3. You are given an array of integers `nums`, and a sliding window of size `k`. Find the maximum value in each sliding window.