Queue Study Note

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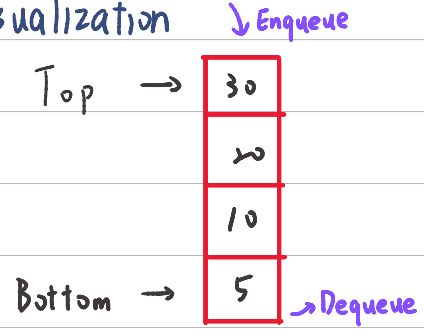
Queue Study Note

1. Definition

Queue is a linear data structure that follows the FIFO (First-In, First-Out) principle.

It sloves problems where the earliest inserted element should be processed first.

2. Visualization



Enqueue at rear. dequeue from front.

3. Time / Space Complexity

Operation	Array Stack	Linked list Stack
Enqueue	O(1)	O(1)
Dequeue	O(1)	O(1)
Peek	O(1)	O(1)
Space	O(n)	O(n)

4. charaterristics

- ordering : Linear, FIFO
- Indexing : No random access
- Dynamic size : Yes. fixed/dynamic (linked list. Array)
- Memory layout : Array - contiguous . Linked list - nodes with pointers
- Typical operations : enqueue . dequeue. front, isEmpty

5. Limitations

- Naive array queue may overflow unless circular logic is used
- Random access not supported
- Linked list version uses additional pointer memory .

6. Use Cases

1. Task scheduling / CPU scheduling
2. Buffering (I/O buffer, network packets)
3. Breadth-first search

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6. Pros / Cons

Pros :

- Fair processing order
- Efficient O(1) operations
- Useful in scheduling and buffering tasks

Cons :

- Not suitable for random access
- Fixed-size array queue may overflow
- For large-scale applications, must manage memory carefully