Priority Queues

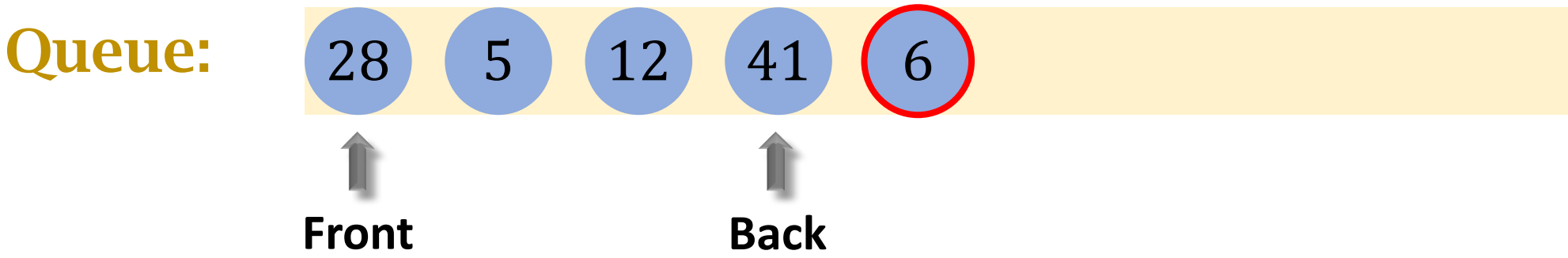
Shusen Wang

Standard Queues

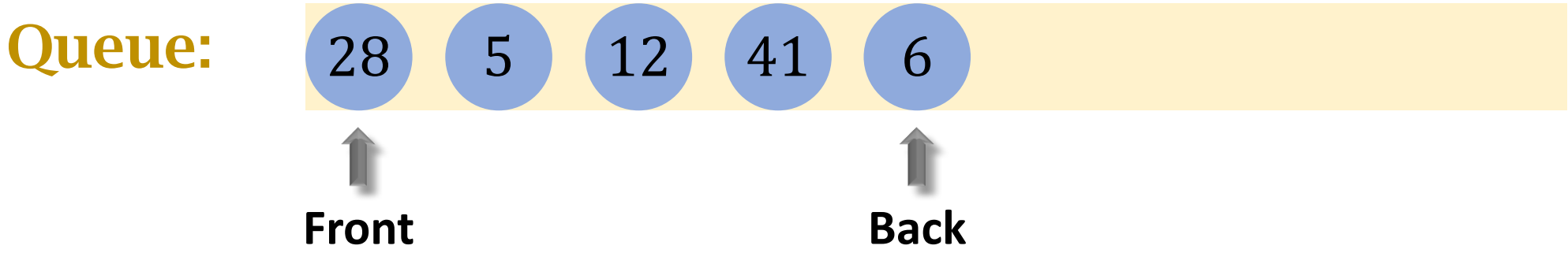
Current State

Queue:

Enqueue(6)

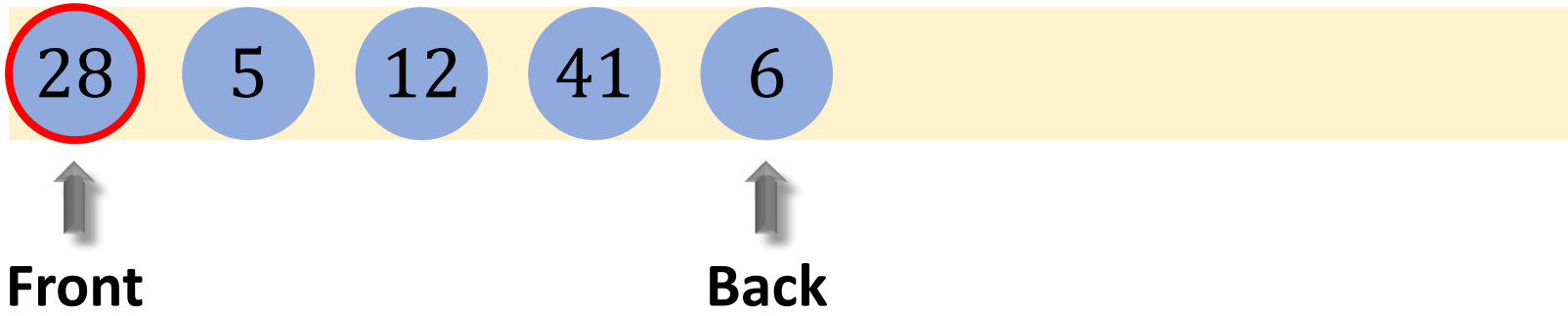


After Enqueue(6)



Dequeue()

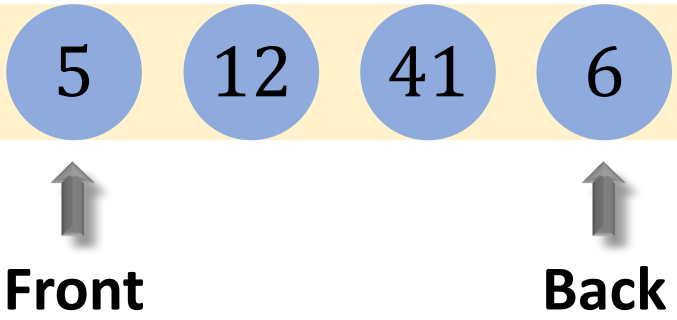
Queue:



Return:

After Dequeue()

Queue:



Return: 28

Priority Queues

Priority Queues

Priority queues support two operations:

- `insert(i)`: insert a new element `i` into the queue.
- `deleteMin()`: Find, return, and delete the minimum.

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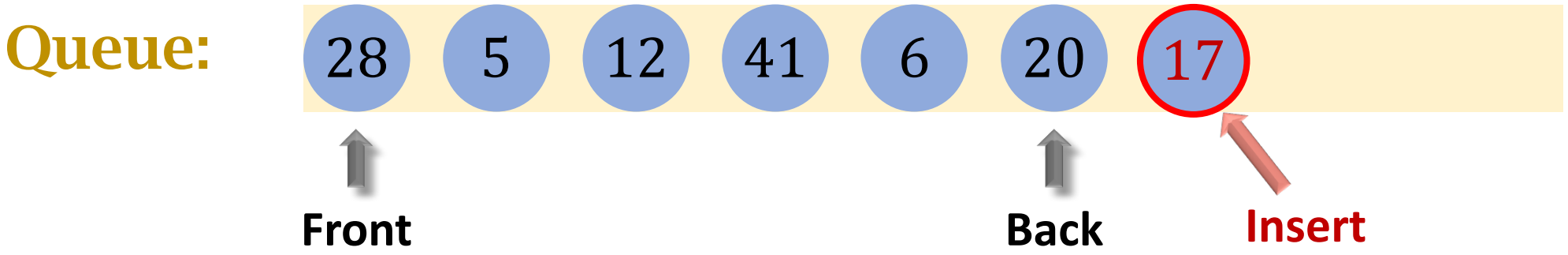
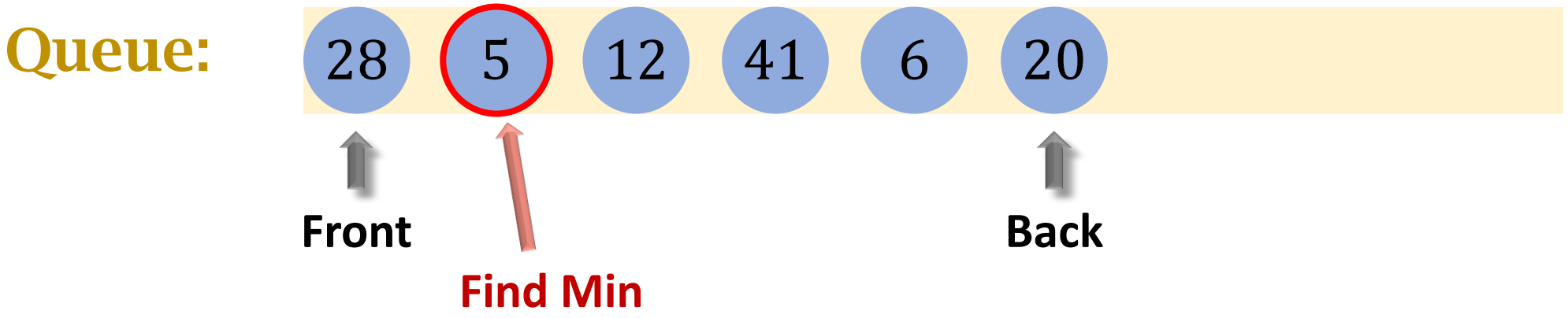
Question: How to implement priority queue?

Naïve Solution 1: Standard Queue



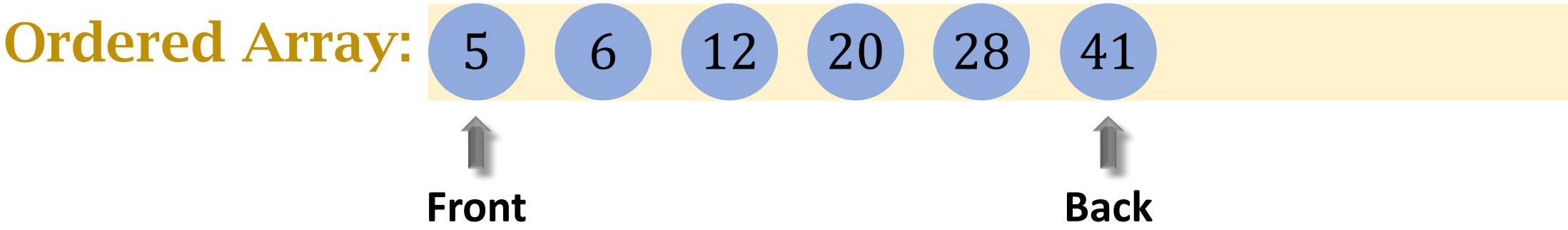
- `insert(i)`: $O(1)$ time.

Naïve Solution 1: Standard Queue



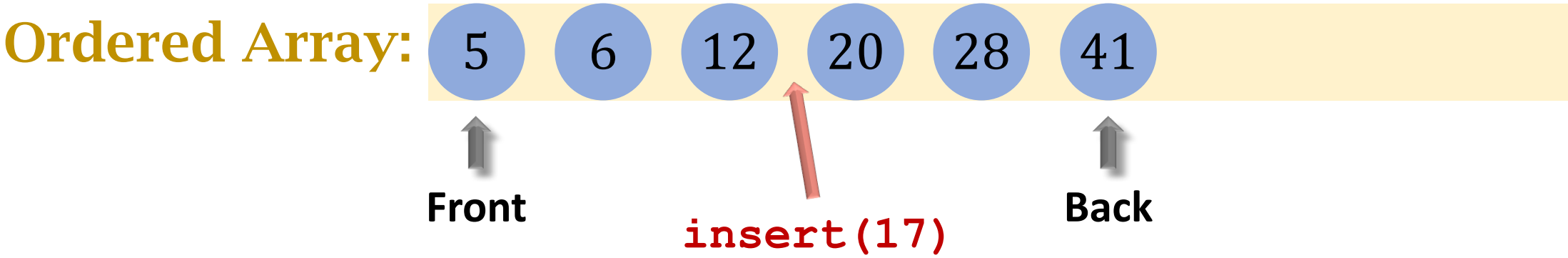
- `insert(i)`: $O(1)$ time.
- **`deleteMin()`**: $O(n)$ time (due to the search of the minimum.)

Naïve Solution 2: Ordered Array



- `insert(i)`: $O(n)$ time.
  - $O(\log n)$ time for searching the position.
  - $O(n)$ time for moving the bigger elements backward.

Naïve Solution 2: Ordered Array



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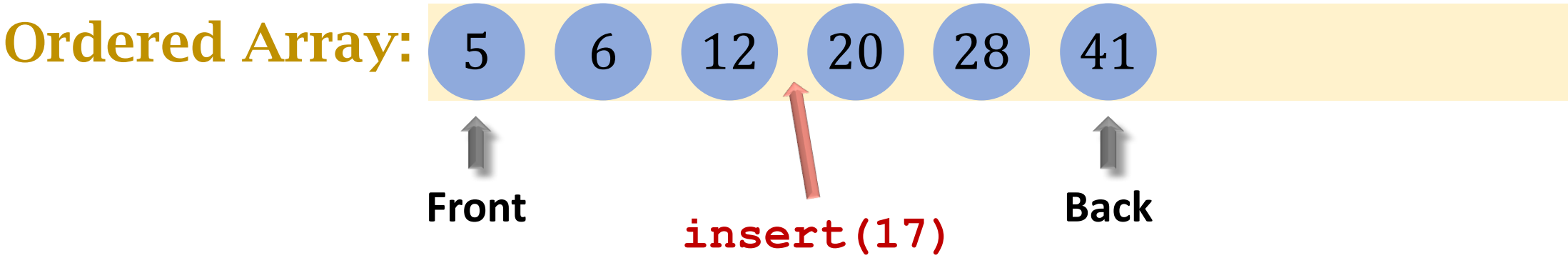

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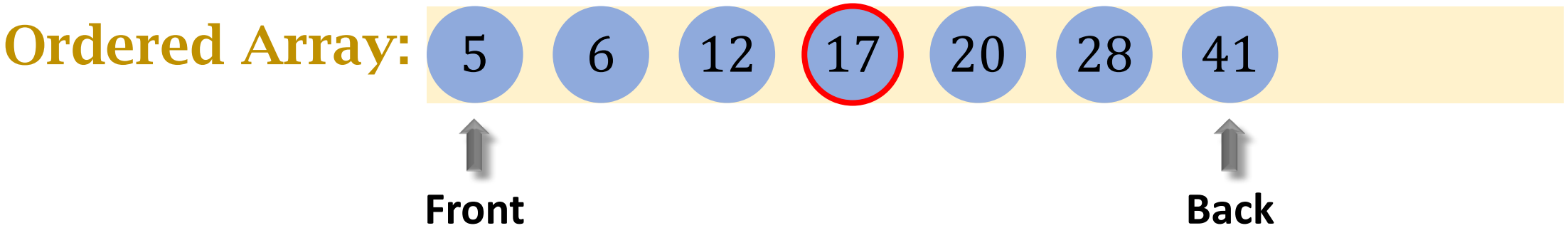

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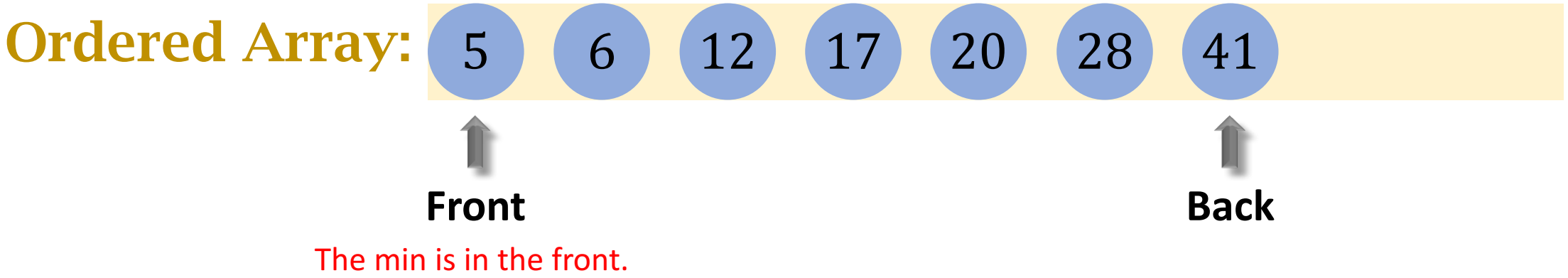
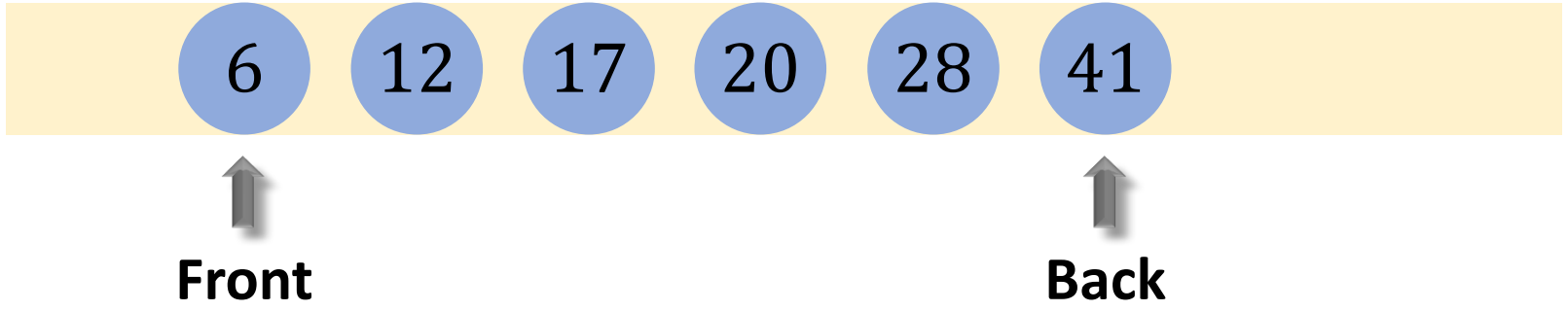


- `insert(i)`: $O(n)$ time.
- **`deleteMin()`**: $O(1)$ time.

Naïve Solution 2: Ordered Array

Ordered Array:



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Implementations of Priority Queue

	Insertion	DeleteMin
Standard Queue	$O(1)$	$O(n)$

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	Insertion	DeleteMin
Standard Queue	$O(1)$	$O(n)$
Ordered Array	$O(n)$	$O(1)$
Binary Heap	$O(\log n)$	$O(\log n)$

Thank You!