DATA STRUCTURES AND ALGORITHMS

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Priority Queue

- A priority queue is a **special type of queue** in which each element is associated with a **priority value**. And, elements are served on the basis of their priority. That is, higher priority elements are served first.
- However, if elements with the same priority occur, they are served according to their order in the queue.

Difference between Priority Queue and Normal Queue

- In a queue, the **first-in-first-out rule** is implemented whereas, in a priority queue, the values are removed **on the basis of priority**. The element with the highest priority is removed first.

Implementation of Priority Queue

- Priority queue can be implemented using an array, a linked list, a heap data structure, or a binary search tree. Among these data structures, heap data structure provides an efficient implementation of priority queues.
- Hence, we will be using the heap data structure to implement the priority queue in this tutorial. A max-heap is implemented in the following operations.

Priority Queue Operations

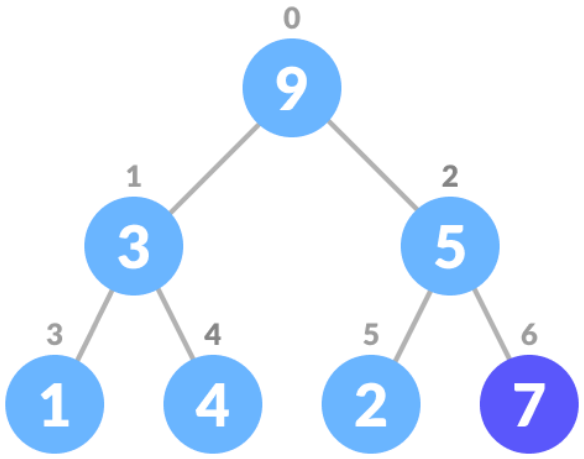
Basic operations of a priority queue are

- inserting,
- removing,
- and peeking elements.

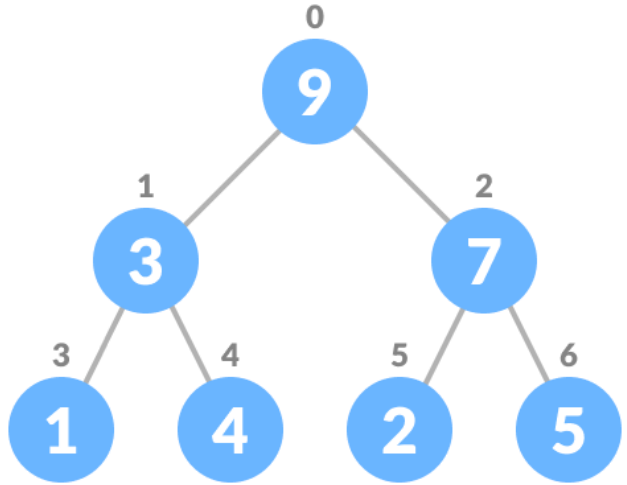
Inserting an Element into the Priority Queue

Inserting an element into a priority queue (max-heap) is done by the following steps.

- Insert the new element at the end of the tree.



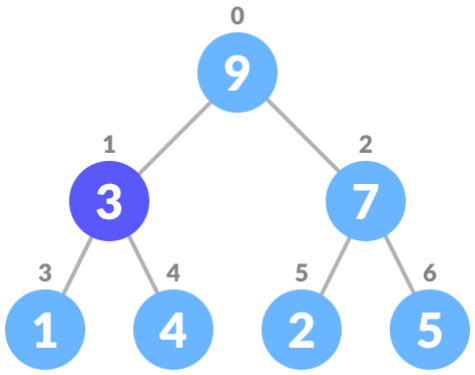
- Heapify the tree



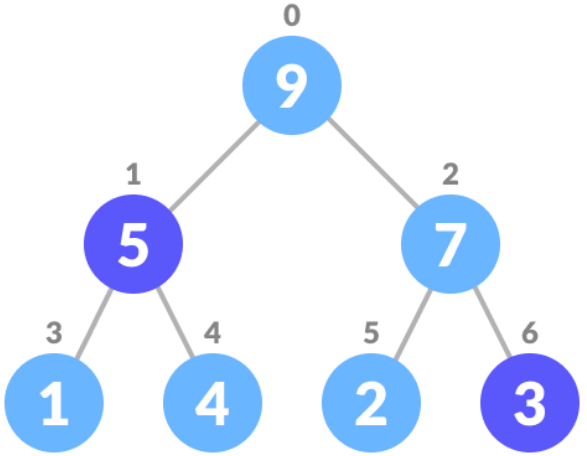
Deleting an Element from the Priority Queue

Deleting an element from a priority queue (max-heap) is done as follows:

- Select the element to be deleted.

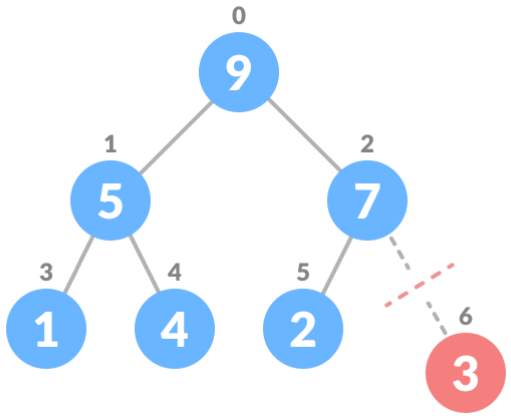


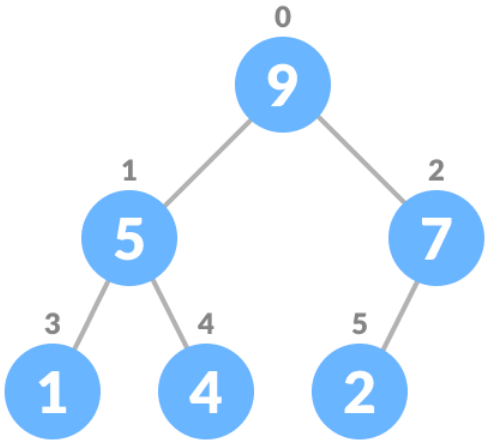
- Swap it with the last element

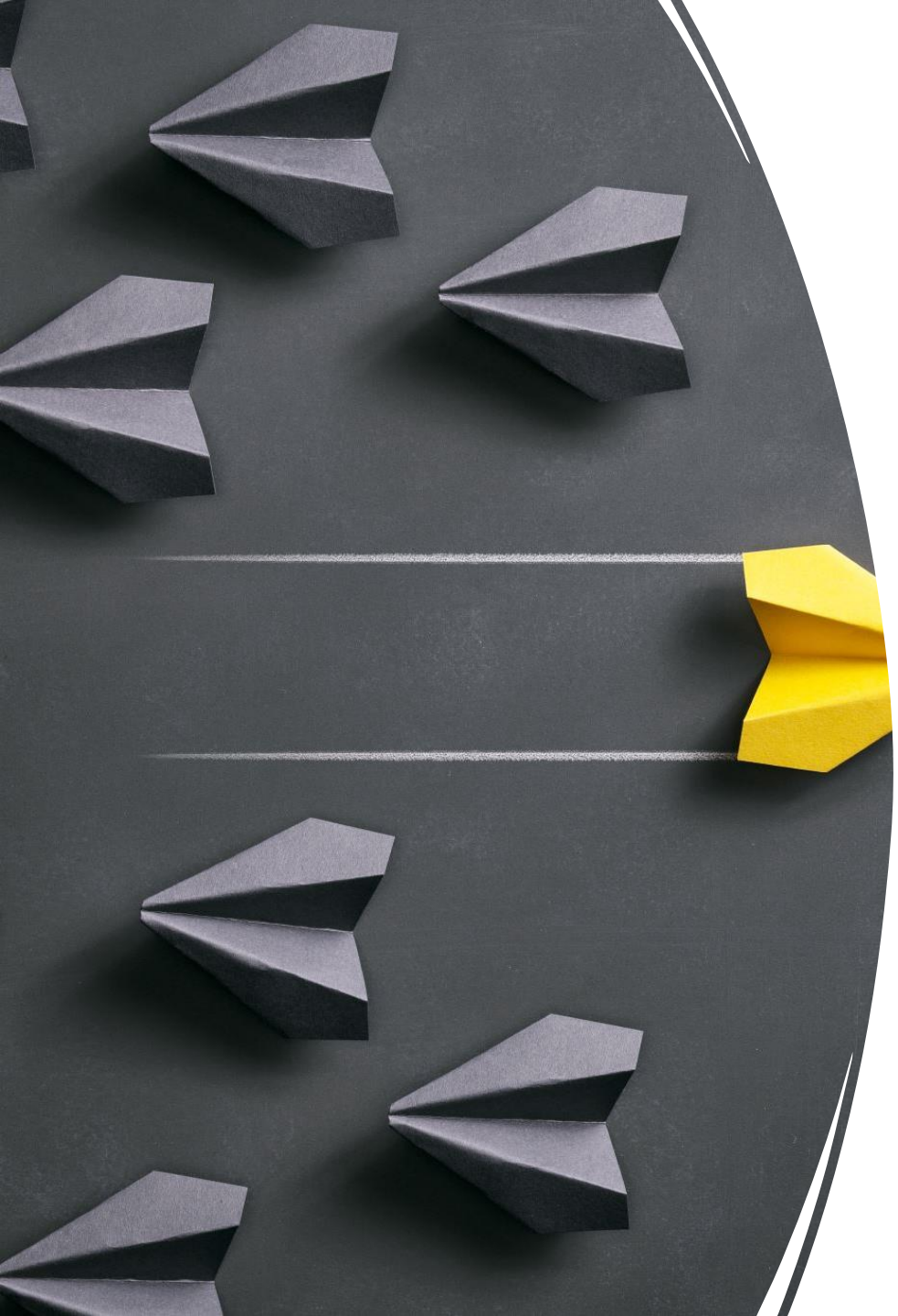


Deleting an Element from the Priority Queue

- Remove the last element.
- Heapify the tree.







Peeking from the Priority Queue (Find max/min)

Peek operation returns the maximum element from Max Heap or minimum element from Min Heap without deleting the node.

- For both Max heap and Min Heap
    - return rootNode

Extract-Max/Min from the Priority Queue

Extract-Max returns the node with maximum value after removing it from a Max Heap whereas Extract-Min returns the node with minimum value after removing it from Min Heap.