

# Priority Queues (Heaps)

## What is a priority queue?

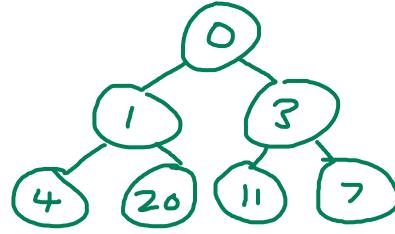
It is an abstract data structure where inserted items are automatically ranked in terms of "importance." We as programmers get to determine what "importance" means.

For example, suppose we have a priority queue that takes in ints; we place highest priority on larger ints. Then when we ask the queue for the next item, it will return the largest int in the queue.

## What is an efficient way to represent priority queues?

Heaps are binary tree where parent nodes have higher priority than child nodes (root = highest priority)

Example: (smaller int = higher priority)

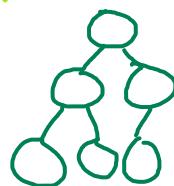
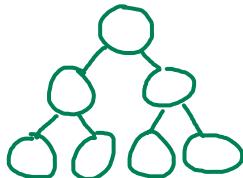


## Properties

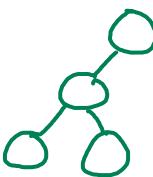
### ① Complete

- a) Missing nodes only at leaf level
- b) All leaf nodes as far left as possible

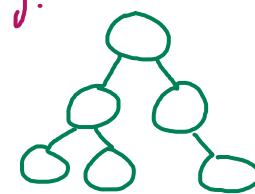
Correct!



Wrong!



(missing node at non-leaf level)

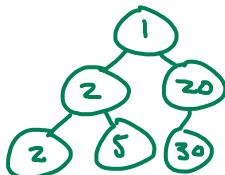


(not all leaf nodes are as far left)

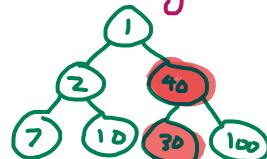
### ② Min-heap Property

Every node has higher or equal priority to their children.

Correct!



Wrong!



## Some Definitions

"End": bottom-most, right-most node

"Swim": a node swaps with parent node in a tree

"Sink": a node swaps with a child node in a tree

## Functions















