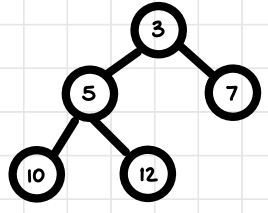# data structures heap

A heap is a specific kind of binary tree that maintains ordered data.

A heap is **complete**, which means
- Each level of the tree is full.
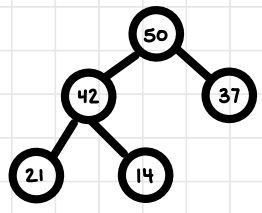- The rightmost elements on the last level may be empty.

min heap

In a min heap, each Node is smaller than its children
— this means the root element is the minimum.

max heap

In a max heap, each Node is larger than its children
— this means the root element is the maximum.

Operations

insert $O(\log n)$

① Insert the Node at the leftmost empty element.

② "Bubble up" — Swap the new Node with its parent until the Node is in the correct position.

remove $O(\log n)$

① Replace the Node with the rightmost element on the bottom level.

② "Bubble down" — Swap the Node with one of its children until the Node is in the correct position.

For min heap — choose the smaller child.
For max heap — choose the larger child.

use cases

Huffman Coding
compression algorithm

implementing
a priority queue.

provides quick access to
the smallest/largest element