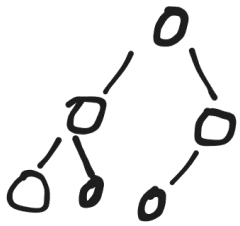
What is a binary Tree?



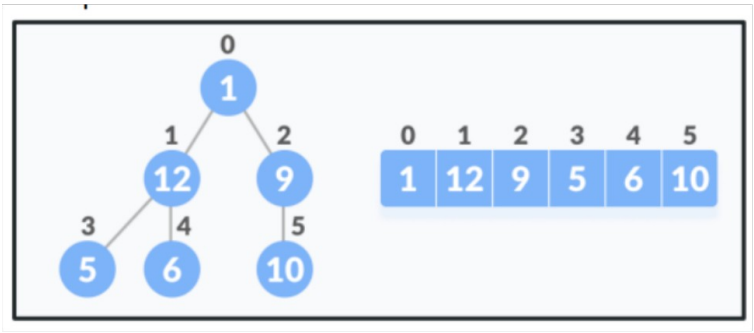
What is a Heap?

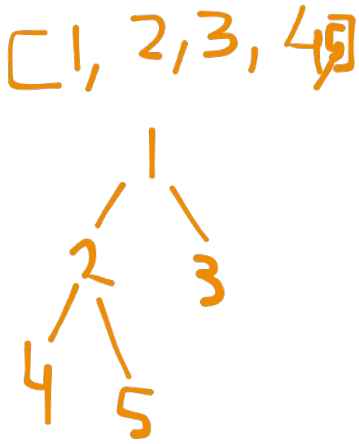
What is a max heap?

the parent nodes, are bigger than the childeren

What is a min heap?

the parent nodes, are smaller than the childeren

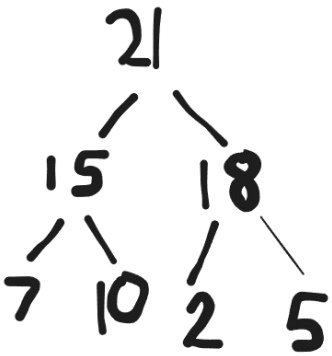




Build a Max Heap!

[15, 7, 2, 10, 18, 5, 21]

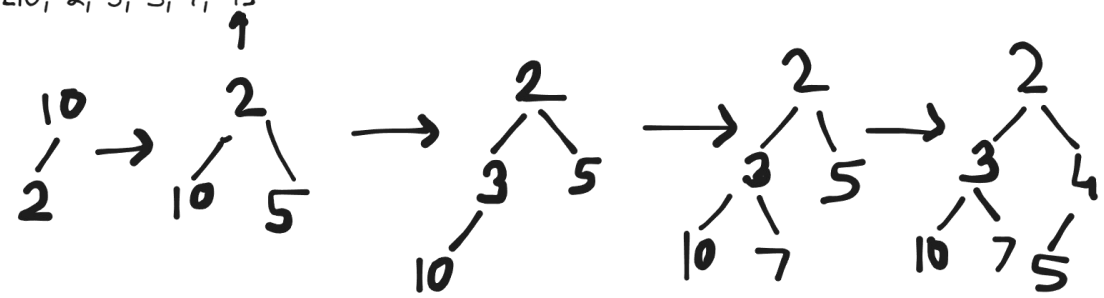
Heapify!



[21, 15, 18, 7, 10, 2, 5]

Build a Min-Heap!

[10, 2, 5, 3, 7, 4]

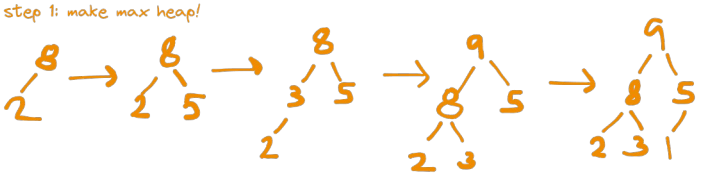


[2, 3, 4, 10, 7, 5]

Heap Sort!

[2, 8, 5, 3, 9, 1] smallest to largest (ascending)

step 1: make max heap!



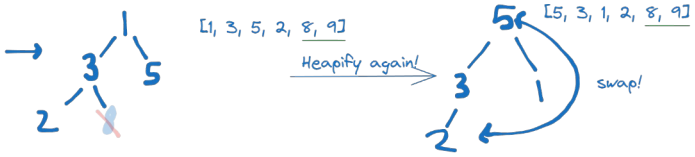
[9, 8, 5, 2, 3, 1]

step 2: (repeat until sorted)
take the top, swap it with the end, and consider it sorted

[9, 8, 5, 2, 3, 1]

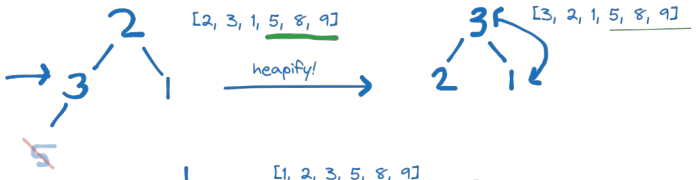
[1, 8, 5, 2, 3, 9] (heapify again!)

[8, 3, 5, 2, 1, 9] swap!



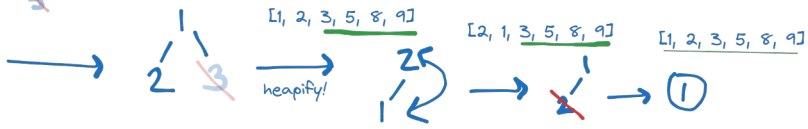
[1, 3, 5, 2, 8, 9] Heapify again!

[5, 3, 1, 2, 8, 9] swap!



[2, 3, 1, 5, 8, 9] heapify!

[3, 2, 1, 5, 8, 9]



[1, 2, 3, 5, 8, 9] heapify!

[2, 1, 3, 5, 8, 9]

[1, 2, 3, 5, 8, 9]

1) Build the right heap
   Max heap if smallest to biggest
   Min heap if biggest to smallest

2) swap the top with the last number in the array

3) remove the last value from the heap, and re-heapify!

4) repeat until there is only one value left in the heap!

Big O: O(nlogn)

Given an array, how can you tell if its a max heap?

loop through the array, check if left is smaller than the parent, check if the right is smaller than the parent, otherwise return false.

left: 2i + 1
right: 2i + 2

biggest = i