Heap Notes 1

Friday, 24 January 2020   7:42 PM

Heaps

Problem: n ropes

$\overline{\quad} \qquad \overline{\quad} \qquad \overline{\quad} \qquad \overline{\quad}$
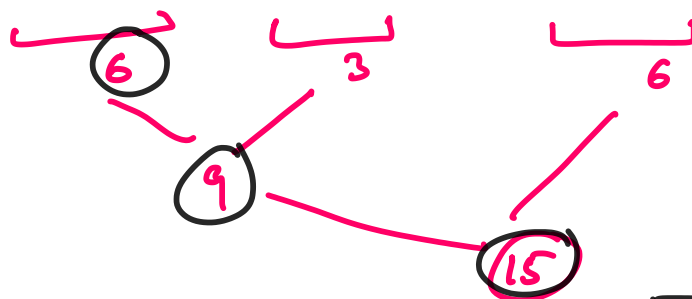 4   2   3   6   .

Join all ropes to form a single rope
→ At a time, two ropes can be connected.

Cost = $L_1 + L_2$

① possibility

$r_1 + r_2 = 4 + 2 = 6$

Total cost → $6 + 9 + 15$ → $\boxed{30}$

✳ <u>Minimize the cost.</u>
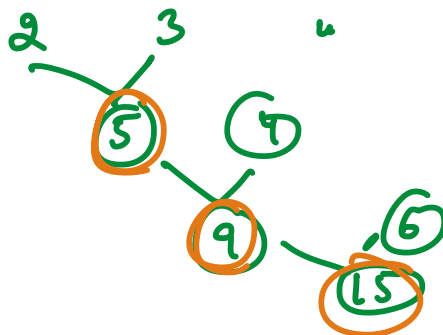
$5 + 9 + 15$ → 29

Ans →

Approach: let say

$\overline{\quad} \qquad \overline{\quad} \qquad \overline{\quad}$
 r_1 r_2 r_3

$$r_1 < r_2 < r_3$$

Select smallest size rope first

① ① $r_1 + r_2$

$\overline{(r_1 + r_3)}$ $\overline{(r_3)}$

② $(r_1 + r_2) + r_3$

$(r_1 + r_2) + (r_1 + r_2 + r_3)$

② ① $(r_2 + r_3)$

$\overline{r_2 + r_3}$ $\overline{r_1}$

② $(r_2 + r_3) + r_1$

$r_2 + r_3 + r_2 + r_3 + r_1$

✗ Selecting the smaller one first is making it to repeat more times

why sorting will not work?

Lets say ropes are

4, 3, 3, 5, 6

6, 4, 5, 6

Now, you need to insert 6 at the right position

Time complexity → $O(n)$

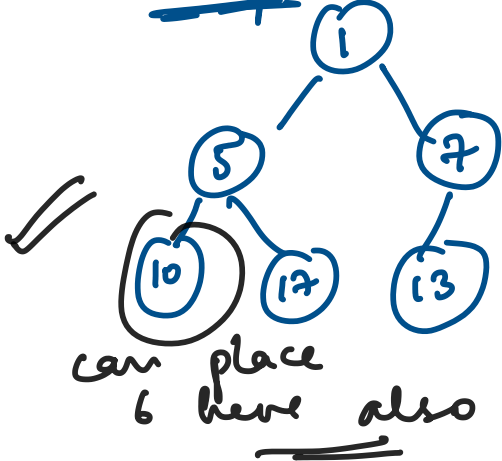We want a data structure which can provide its the minimum in efficient time.

Data structure → (Heap)

Binary Heap

Binary Tree
① Complete BT
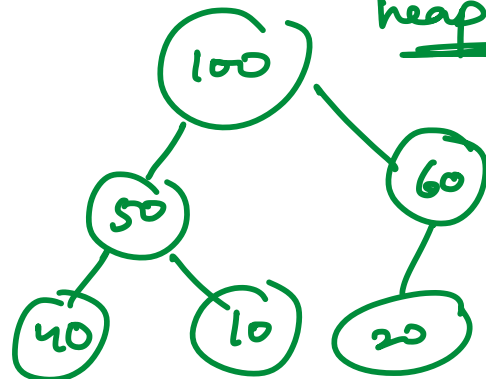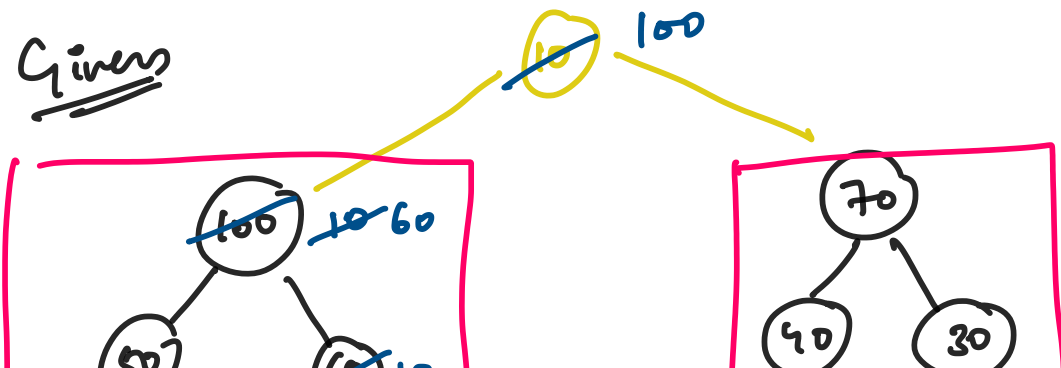② All the nodes should follow min/max property

→ No relation b/w two subtrees

Min Heap

```
        1
       / \
      5   7
     / \   \
    10  17  13
```

can place 6 here also

Max Heap

```
        100
       /    \
      50     60
     /  \     \
   40   10    20
```

* Maximum value is at root node

Given

```
        10 ── 100

   100 10 60           70
    /    \            /  \
  50     ...         40   30
```

RST

LST

Given LST is a heap & RST is also a max heap, what to do to make whole of it as max heap.

for n → nodes
   Height of CBT → ($\log n$)

To max heap → $O(\log n)$ with the condition that LST & RST both are max heap.

How to Build a heap??

→ If we use ~~array~~ tree we need to store three into along with each node.

L   R
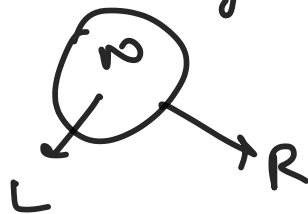
→ Array → Memory efficient
         → Cache efficient