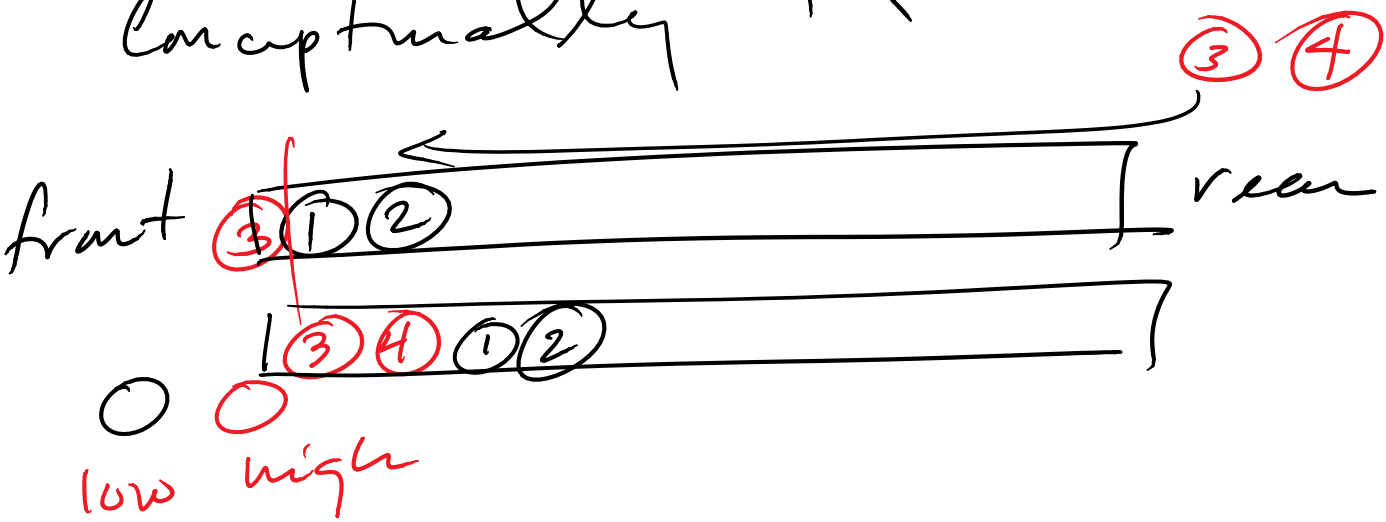
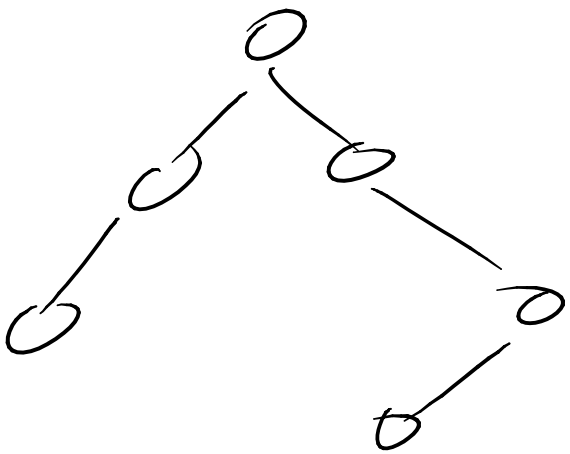
Queues and Priority Queues (PQ)

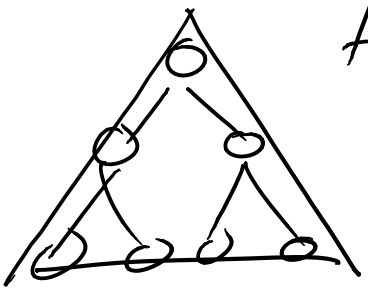
Conceptually PQ



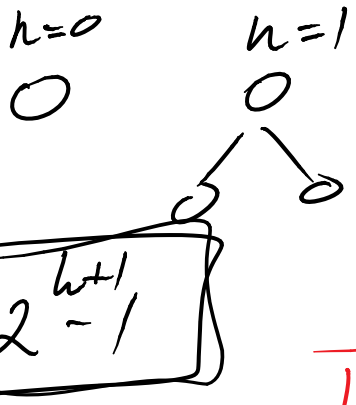
Operating System Run time Queue

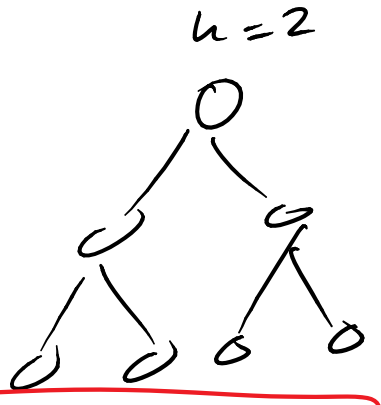
Aside





full binary tree of height h





. . . .

$n = 2^{h+1} - 1$

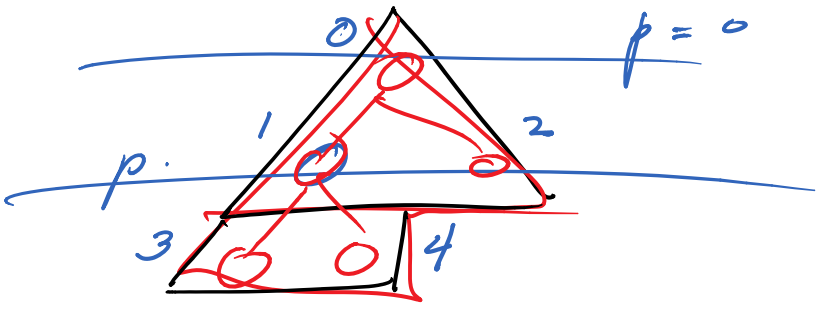
$N = 2^{h+1} - 1$

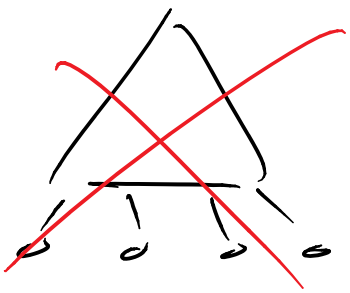
$N+1 = 2^{h+1}$

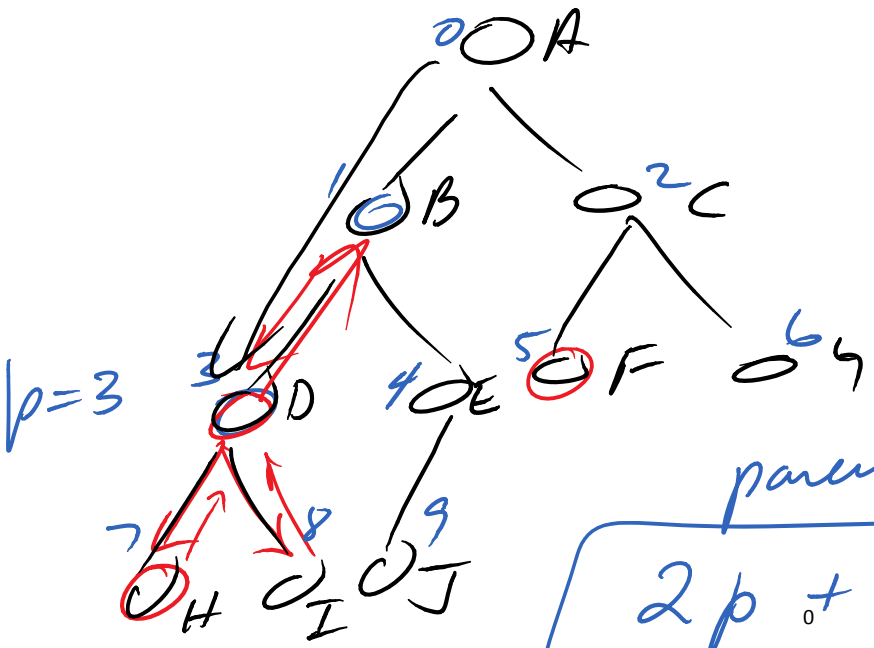
$\log_2(N+1) = h+1$

$\boxed{\log_2(N+1) - 1}$

A complete tree of height h is a full tree through level h-1 and remaining nodes on level h are as far left as possible







parent → child

$$2p_0 + 1 = c_L$$

$$2p + 2 = c_R$$

child → parent

$$p = \frac{c - 1}{2} \leftarrow \text{int div}$$

$2 \cdot (2.0 + 1) + 1$

p

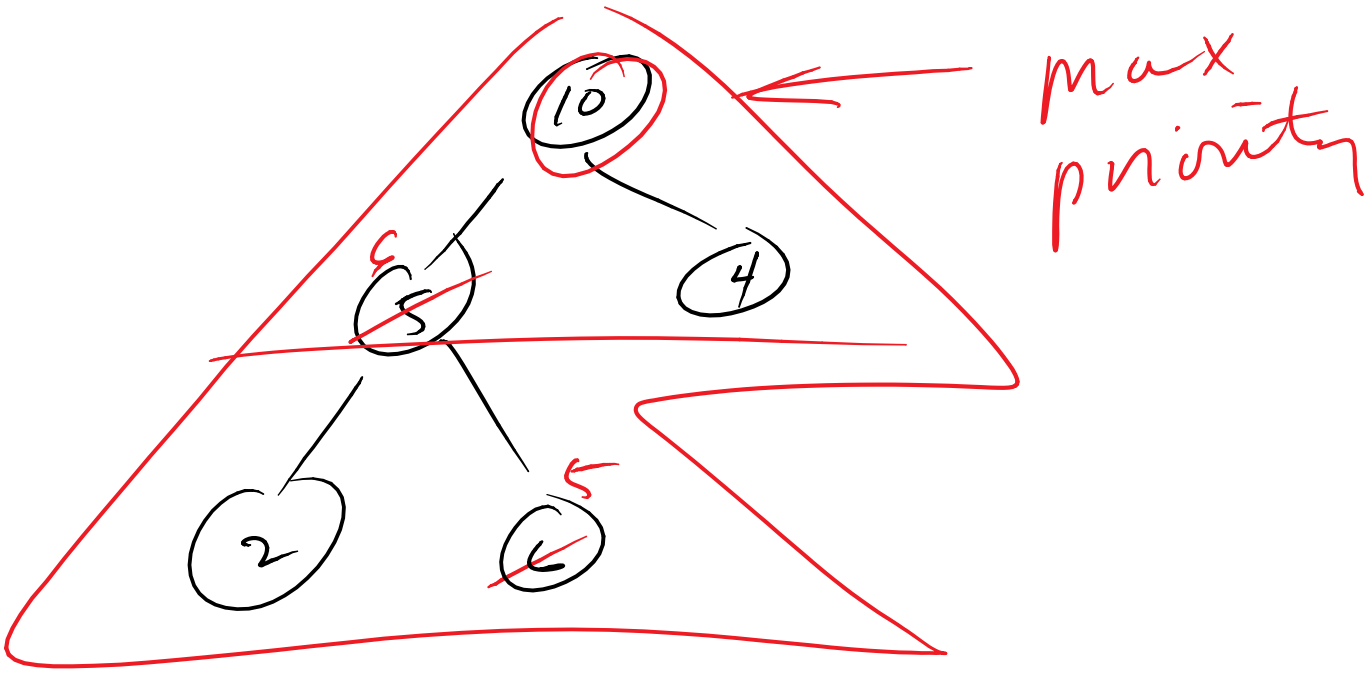
0	1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	G	H	I	J

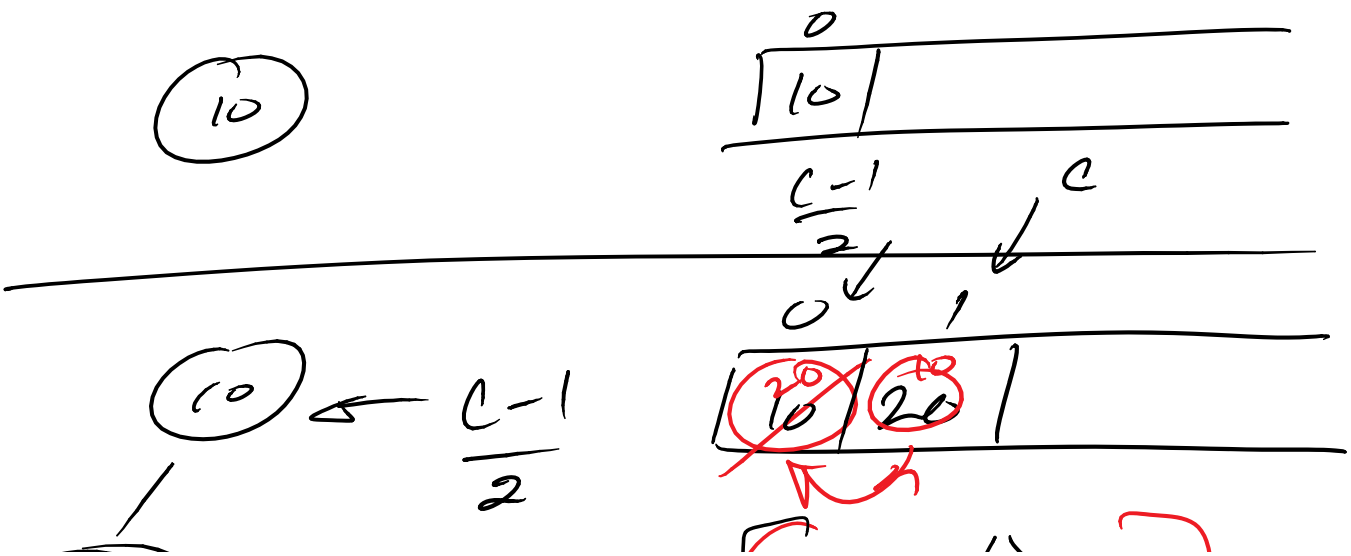
end aside

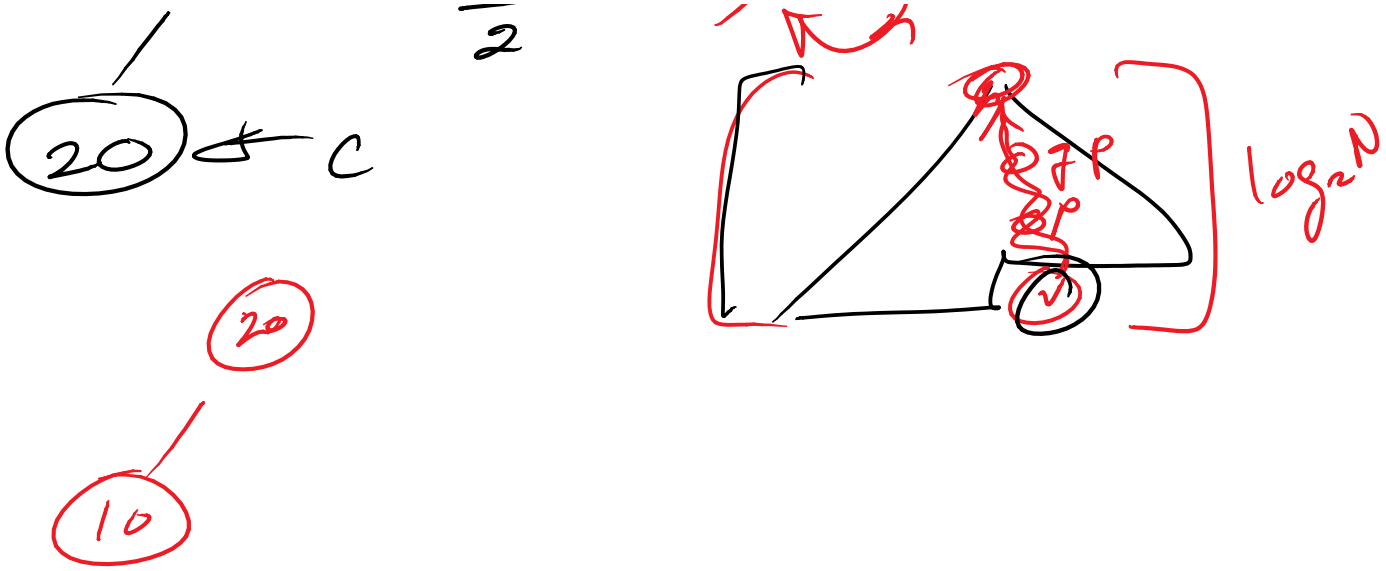
PQ → Heap

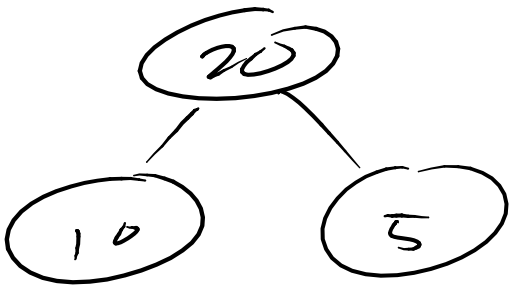
A heap is a complete tree

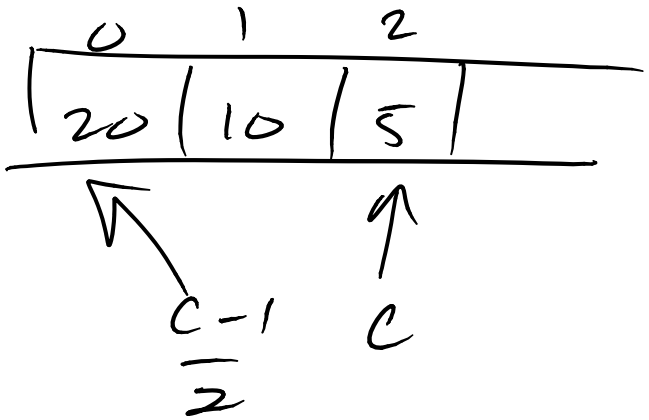
with property that value of root of any subtree is greater than or equal to all of its descendants

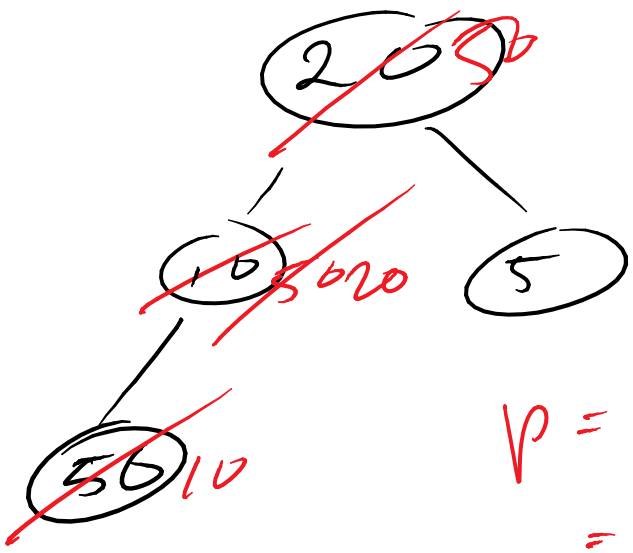


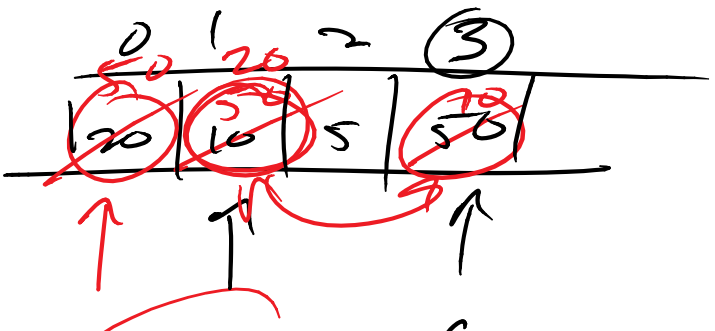












$p = \frac{1-1}{2} = 0$

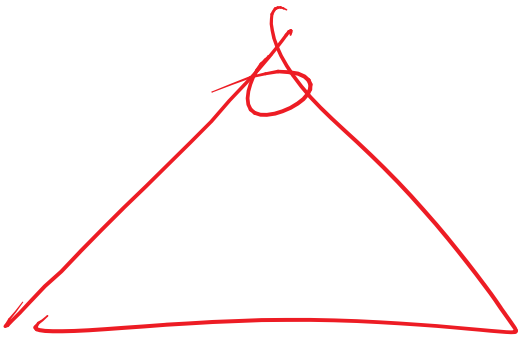
$p = \frac{3-1}{2} = 1$

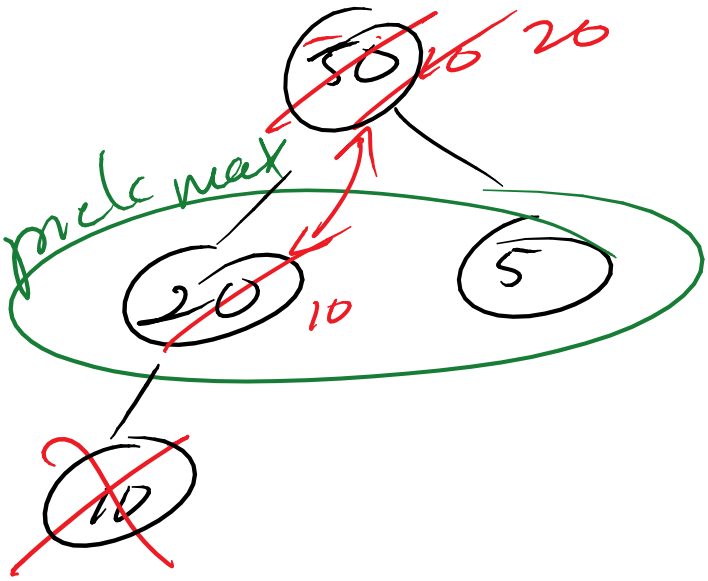
↳ c

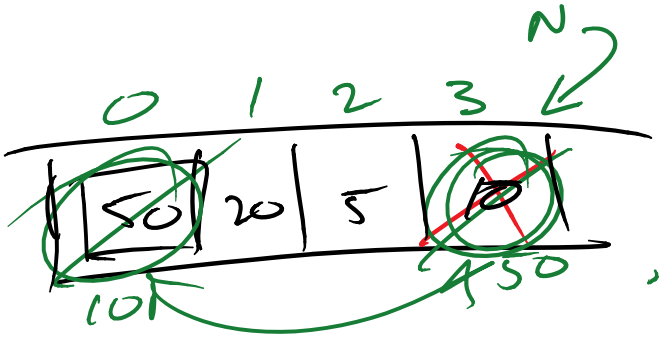
50	20	5	10

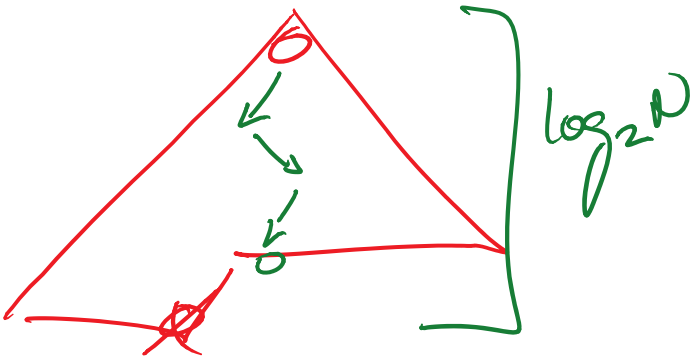
Building a heap of size N

$O(N \log N)$

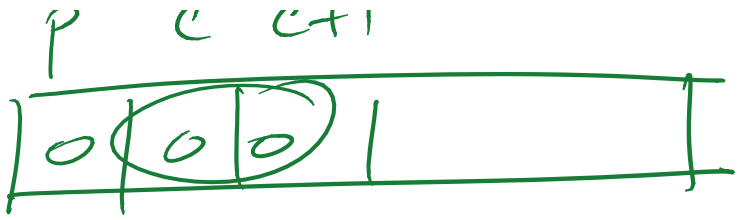




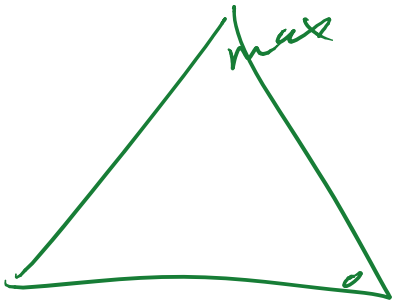




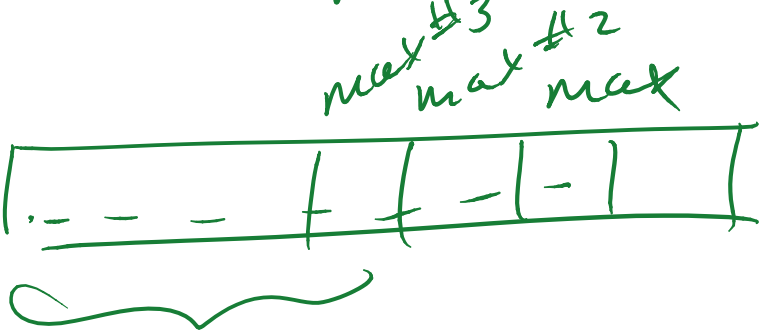
P C C+1



Remove All $N \log N$



heap



Build $O(N \log N)$

Remove $O(N \log N)$

Heap Sort $N \log N + N \log N$

$= O(N \log N)$