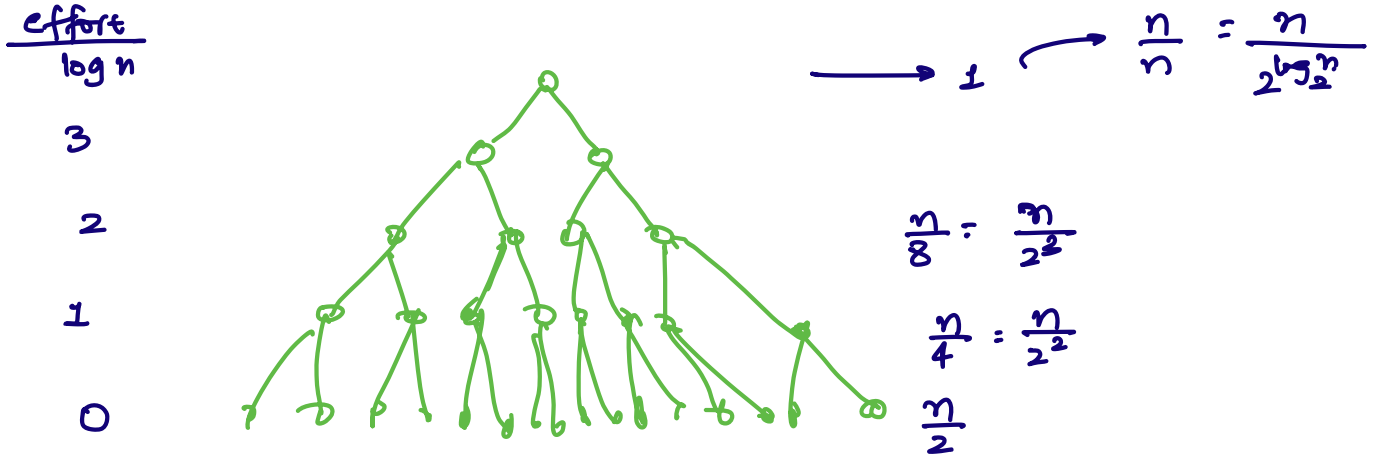


$$S: \quad \frac{n}{2}\times 0 + \frac{n}{2^2}\times 1 + \frac{n}{2^3}\times 2 \cdots\cdots \frac{n}{2^{\log_2 n - 1}}(\log_2 n - 2) + \frac{n}{2^{\log_2 n}}(\log_2 n - 1)$$

$$2S: \quad n\times 0 + \frac{n}{2}\times 1 + \frac{n}{2^2}\times 2 + \frac{n}{2^3}\times 3 \qquad \frac{n}{2^{\log_2 n - 1}}(\log_2 n - 1)$$

$$2S - S: \quad \frac{n}{2} + \frac{n}{2^2} + \frac{n}{2^3} + \longrightarrow \frac{n}{2^{\log_2 n - 1}} - \frac{n}{2^{\log_2 n}}(\log_2 n - 1)$$

$$n\left(\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \longrightarrow \frac{1}{2^{\log_2 n - 1}}\right)$$

$$\frac{\frac{1}{2}\left(1 - \left(\frac{1}{2}\right)^{\log_2 n - 1}\right)}{1 - \frac{1}{2}} = 1 - \left(\frac{1}{2}\right)^{\log_2 n - 1}$$

$$= 1 - \frac{\left(\frac{1}{2}\right)^{\log_2 n}}{\left(\frac{1}{2}\right)}$$

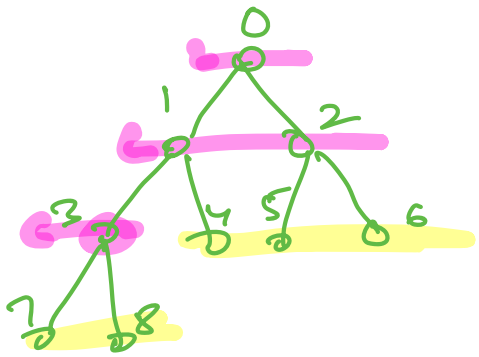
$$= 1 - \frac{2^{-\log_2 n}}{\left(\frac{1}{2}\right)} = 1 - \frac{\left(\frac{1}{n}\right)}{\left(\frac{1}{2}\right)}$$

$= 1 - \frac{2}{n} = \frac{n-2}{n}$

$\simeq O(1)$

$n(1) - \frac{n}{2^{\log_2 n}} (\log_2 n - 1)$

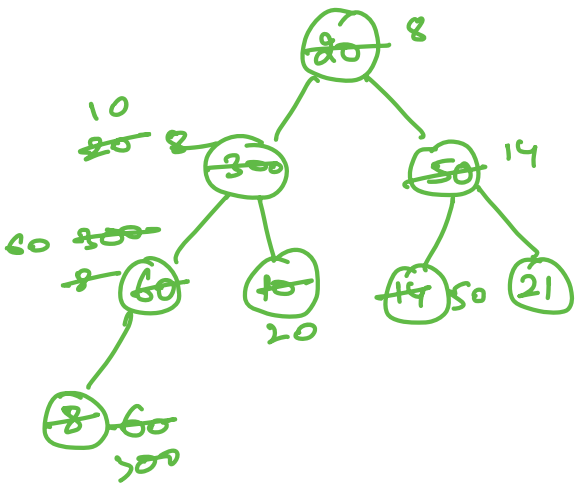
$n - \log_2 n + 1 = O(n)$

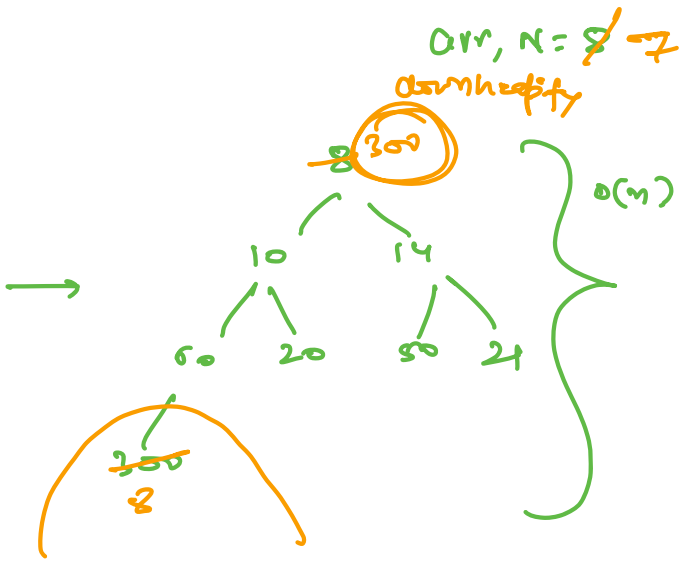


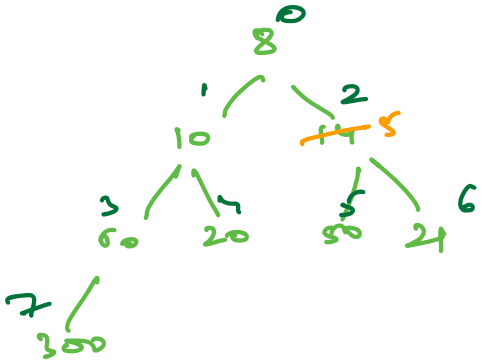
$N = 9$

$\frac{N}{2} \rightarrow N-1$ } leaf

$\frac{9}{2} = 4 \rightarrow 8$ } leaf







$2 \rightarrow 5$

$arr(2) = 5$ ✗

upheapify(2)

Heap Sort

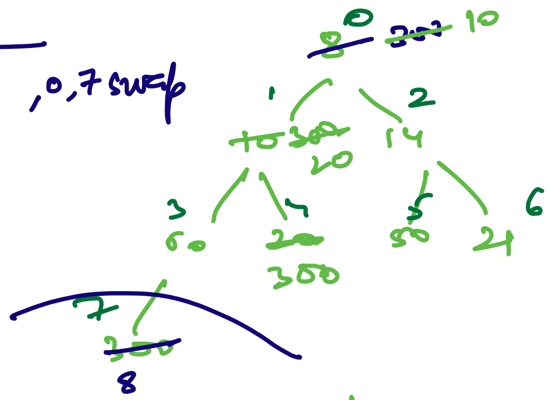
n elements → heap create

dec

bigger — small

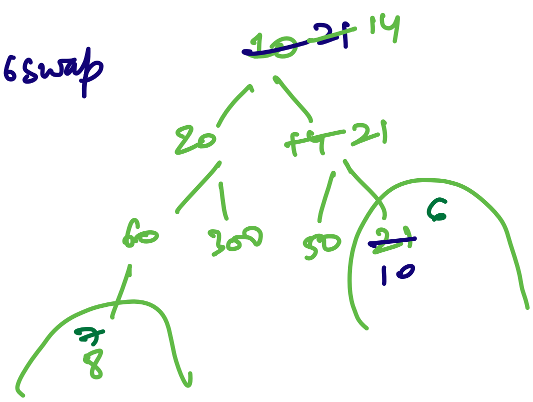
N=8

i=7 ,0,7 swap



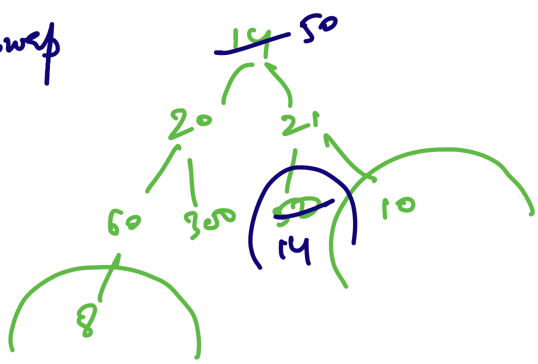
down (0,7)

i=6 0,6 swap



down (0,6)

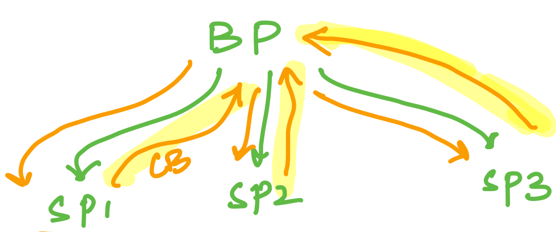
i=5 0,5 swap



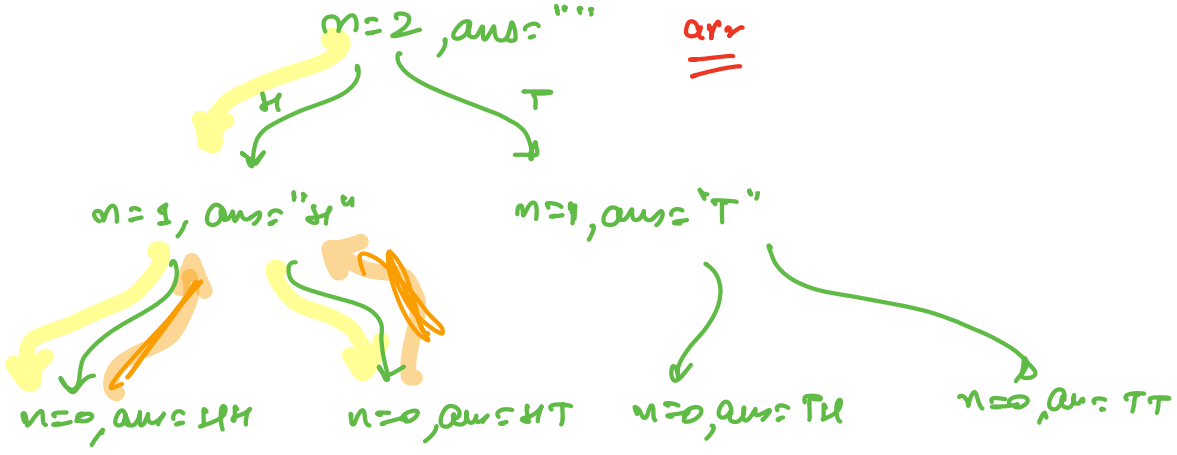
down (0,5)

Backtracking

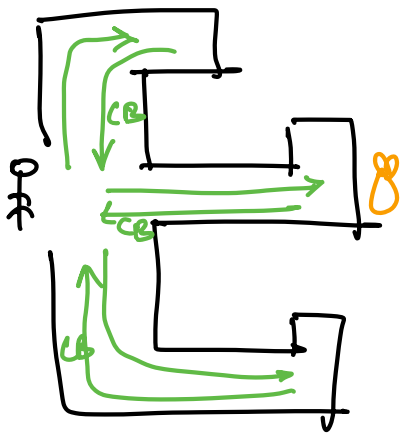
DP ?

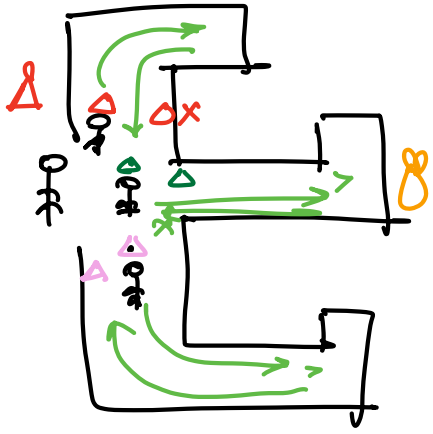


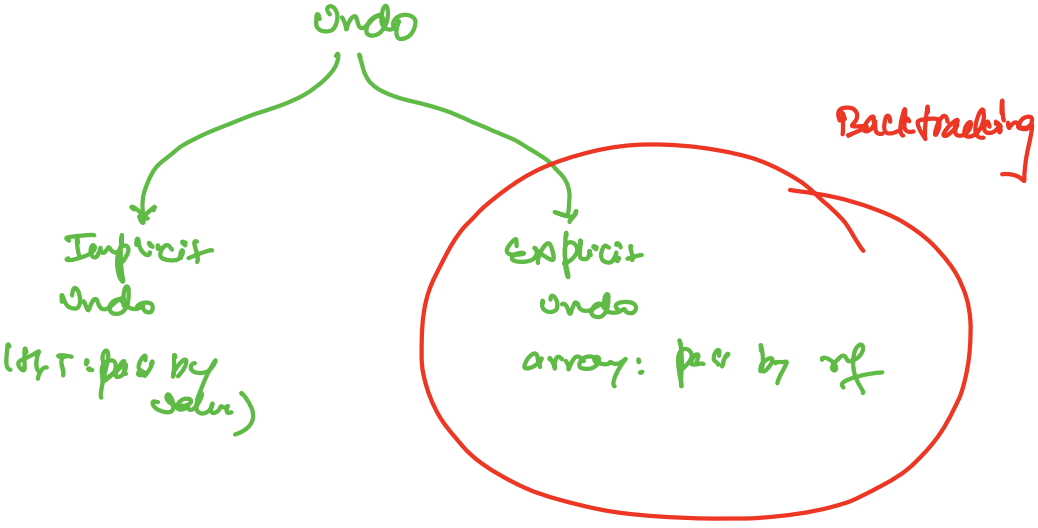
Pass by Value



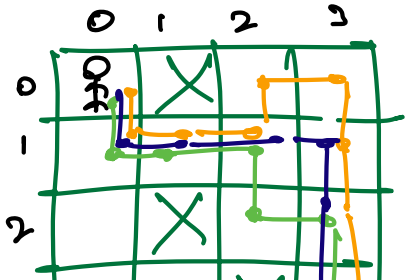
arr







Blocked Maze



(0,0) ⟶ (3,3)

DRRDRD
DRRURDDD
DRRRDD