

Bonus Lecture - 4  
Some Bonus Problem Solving

RECAP

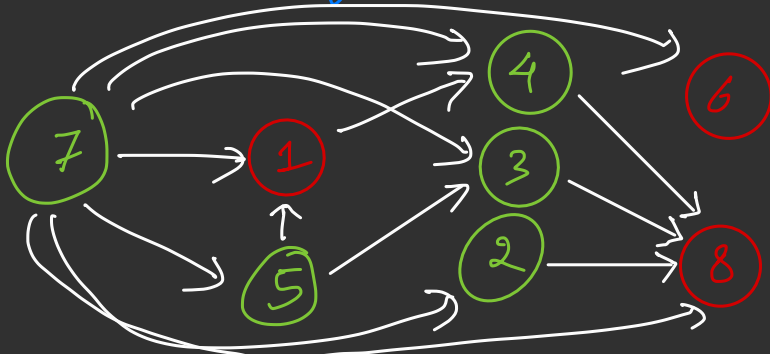
Let's get started!

# 1. Permutation Game

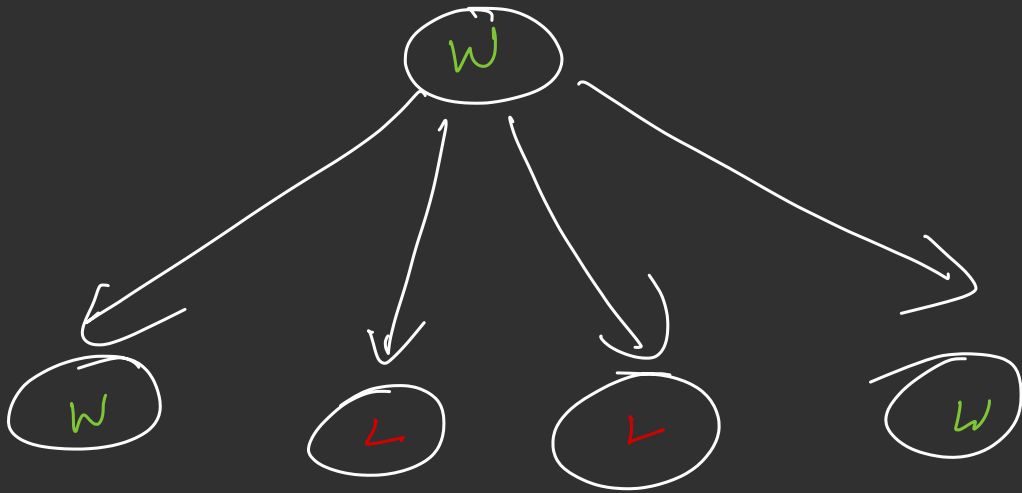
B A A A A B A B

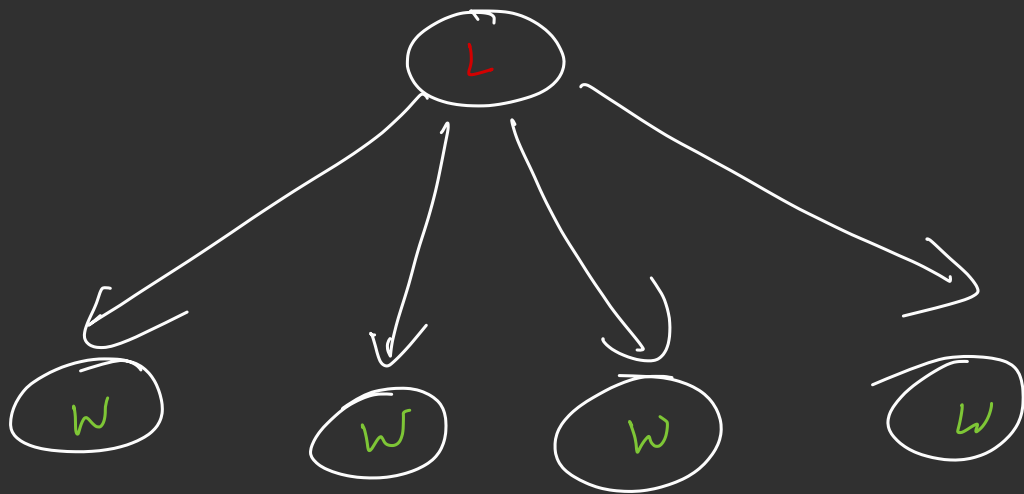
$N = 8$

3	6	5	4	2	7	1	8
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>



The state graph will be  
a DAG.





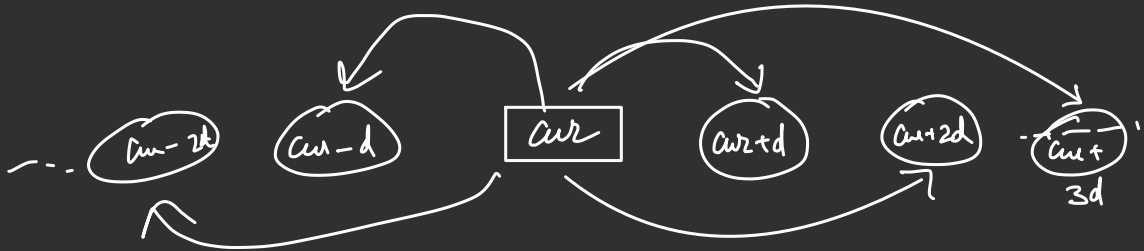
## Intuition / Solution

cur

$a_{cur}$

$$a_{nb} > a_{cur}$$

$$|nb - cur| \% a_{cur} \neq 0$$





$$\text{If } a[\text{cur}] = d$$

$$\Rightarrow \text{outdegree}[\text{cur}] \leq \frac{n}{d}$$

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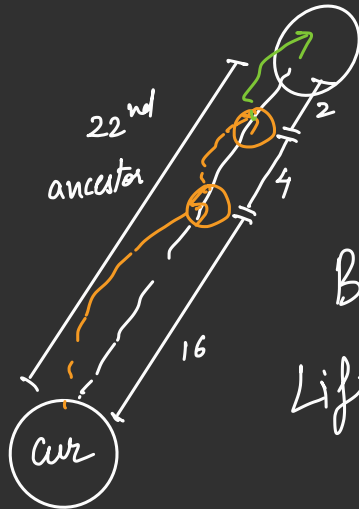
$$\text{No. of edges} = N + \frac{N}{2} + \frac{N}{3} + \frac{N}{4} + \frac{N}{5} \dots \frac{N}{N}$$

$$\Rightarrow N \left( 1 + \frac{1}{2} + \frac{1}{3} \dots \frac{1}{N} \right) \approx N \log N$$

Let's implement

## 2. Kth Ancestor

## Intuition / Solution



Binary  
Lifting!

$$22 = 16 + 4 + 2$$

$$\Rightarrow 2^4 + 2^2 + 2^1$$

$dp[i][k]$

represents  $2^k$ th ancestor of the node  $i$

$dp[i][0] \Rightarrow 1^{st}$  ancestor  $\Rightarrow$  parent

$dp[i][1] \Rightarrow 2^{nd}$  ancestor  $\Rightarrow$  grandparent

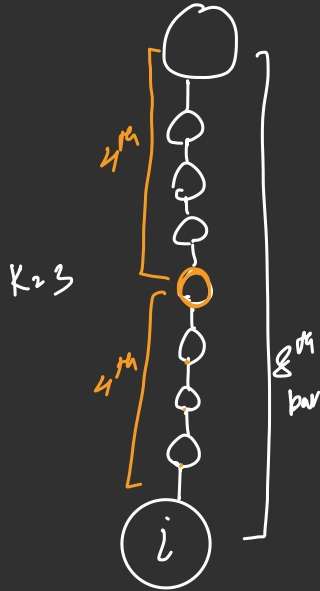
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# Preprocessing

// Base Cases

$$dp[i][0] = \text{parent}[i]$$

$$dp[i][k] = dp[dp[i][k-1]][k-1]$$



Let's implement

# *Thank You!*

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!