

Let's start by 9:05 PM

## L55 Getting Greedy

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# RECAP

Before getting started

# Agenda for today

What is greedy?

Any algorithm that follows the problem solving heuristic of making the locally optimal choice at each stage is called "greedy Algorithm".

## A Simple Example

$[2, 10, 14, 5, 5, 5, 6, 10, 5]$   $\Rightarrow$  *greedy  
doesn't work*

$[2, 10, 15, 5, 4, 4, 10]$   $\Rightarrow$  *greedy  
works*

## Another Example

N diamonds  $\Rightarrow$  W kgs

Bag  $\Rightarrow$  cap. of  
K kgs

$[v_1, v_2, v_3, \dots, v_n]$

- i) Pick the most expensive diamonds until we have space in the bag.

## Follow-Up to another Example

$[v_1 \quad v_2 \quad v_3 \quad \dots \quad v_n]$

$[w_1 \quad w_2 \quad w_3 \quad \dots \quad w_n]$

Highest value first  
weight

Capacity =  $K$   
of Bag

## Frog Jump Problem

$N$  lilypads.

$(N-1)$  are in the pond

$N^{\text{th}}$  one is on the  
other end.



$d[i] \Rightarrow$  distance b/w  $i^{\text{th}}$  &  
 $(i+1)^{\text{th}}$  lilypad.

The frog jump upto  $K$  units  
in 1 hop

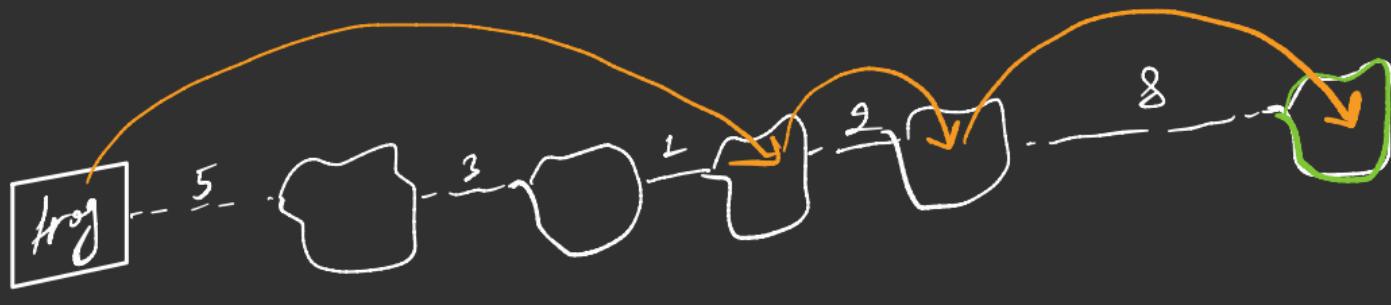
Tell if it is possible for the frog  
to reach the other end?

If yes, what all the minimum no.  
of jumps required.

$$N = 5$$

$$d = [5, 3, 1, 2, 8]$$

$$K = 9$$



jumps = 3

Come on, think of a Greedy Intuition?

Let's implement

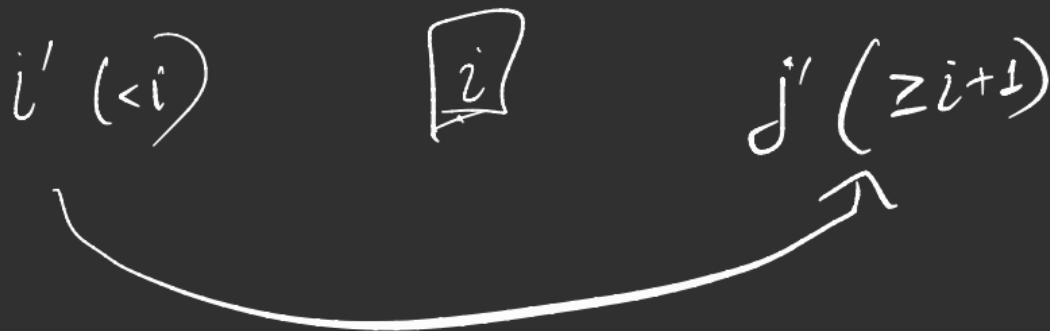
Elephant in the room : How to prove?

"Gwydy stays ahead"

## Step 1 : Proof of Existence

Stuck at  $j^*$  lily pad

$$\hookrightarrow \text{dist}[i \& (i+1)] > k$$



Step 2 : Proof of Optimality  
(using Greedy-Stays-Ahead method)

Let's say,  $b(j)$  represents the position of frog after  $j$  jumps in greedy strategy.

$b^*(j) \Rightarrow$  In any other strategy.

$$b(j) \geq b^*(j) \quad \forall j$$

$$j=0 \quad b(0) \Rightarrow 0$$

$$b^*(0) \Rightarrow 0$$

$$b(0) \geq b^*(0) \Rightarrow \text{holds true}$$

Assume  $b(j) \geq b^*(j)$ , try to prove

$$b(j+1) \geq b^*(j+1)$$

Case 1:  $b(j) \geq b^*(j+1)$

Already proven

$$\hookrightarrow b(j+1) \geq b^*(j+1)$$

Case 2 :  $b(j) < b^*(j+1)$

$$b^*(j+1) \leq b^*(j) + K \quad (b(j) \geq b^*(j))$$

$$\Rightarrow b^*(j+1) \leq b(j) + K$$



# *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!