USA  Tutor

The Bovine Shuffle

Analysis by David Yang

Statement Summary

We are given N<=100,000 cows

We are also given where each cow “goes to”

Find the number of positions where a cow will always be

Random Ideas

Simulate: N^2

When do we stop our simulation?

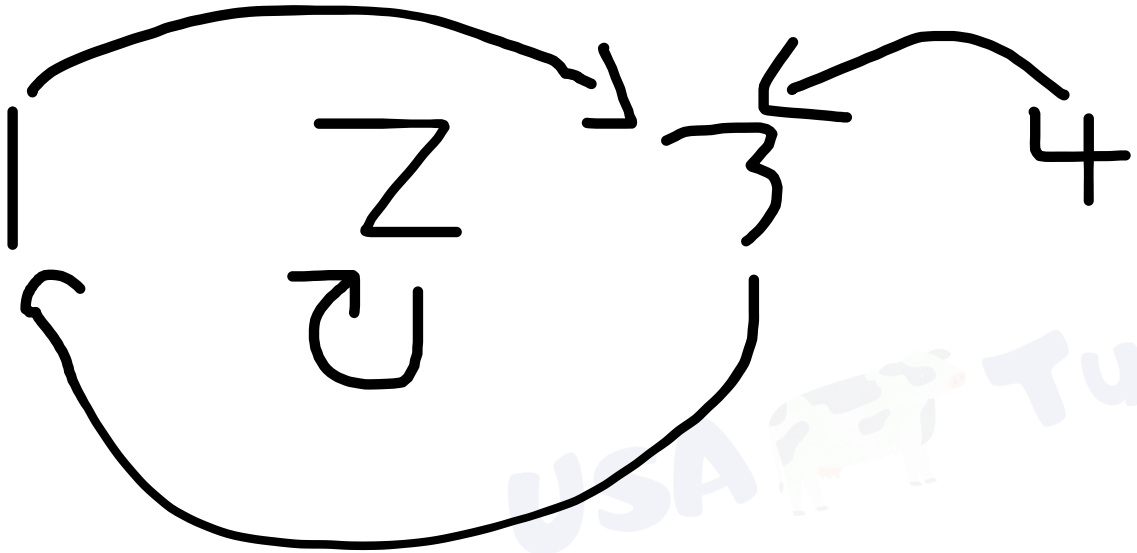
Do we stop at a cow? Stop at a time? How do you know?

Full credit: N?

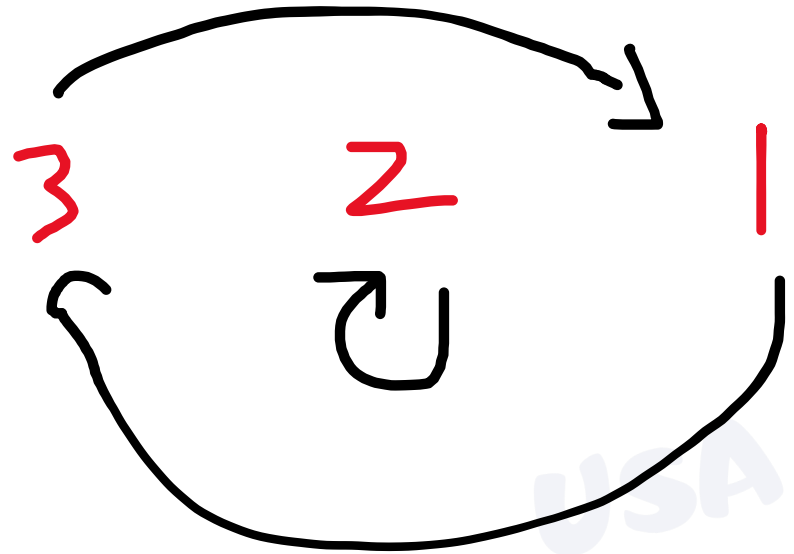
We can realize that *maybe* some spots will always have a cow?

Where do we find those spots?

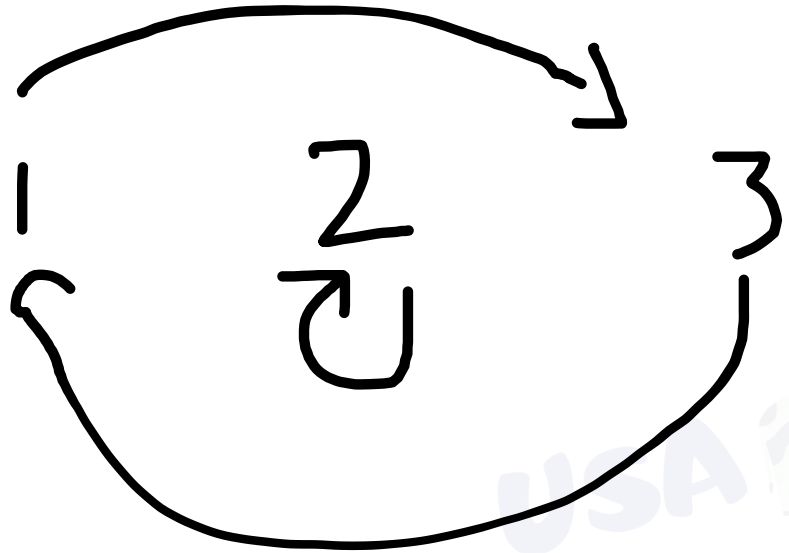
Sample



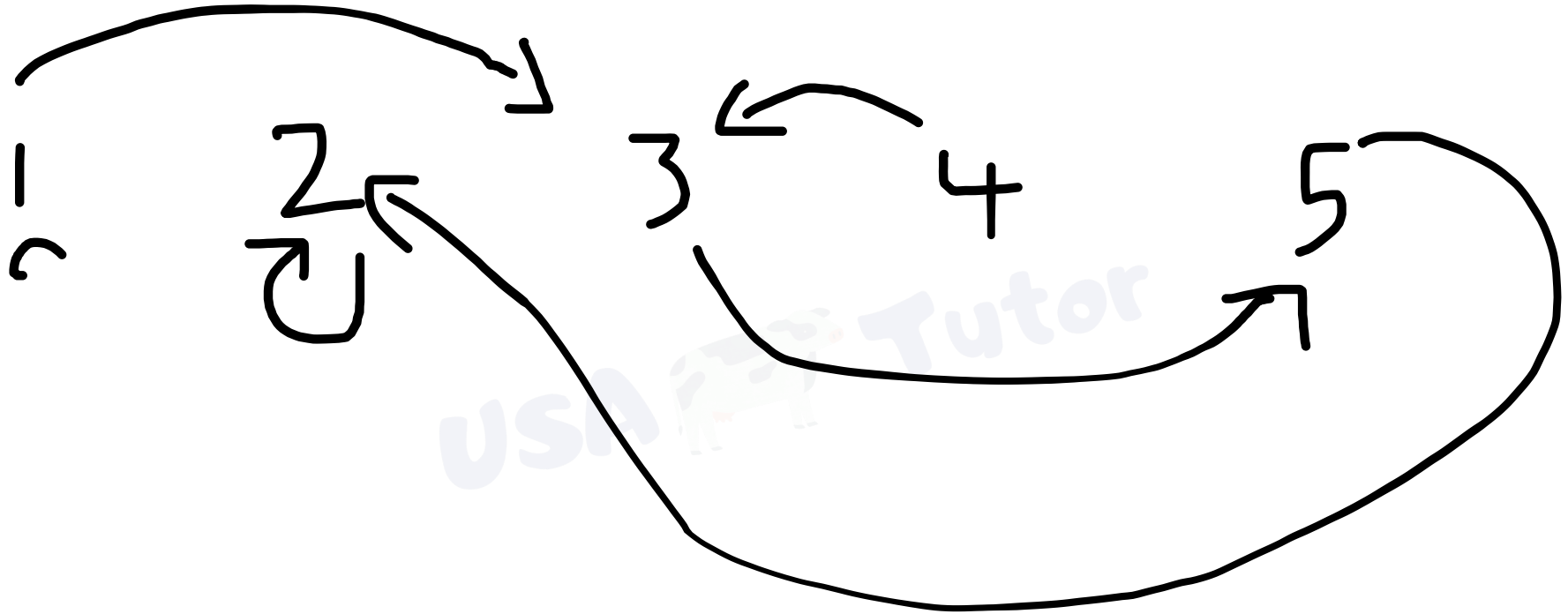
Sample



Sample



Maybe a better sample



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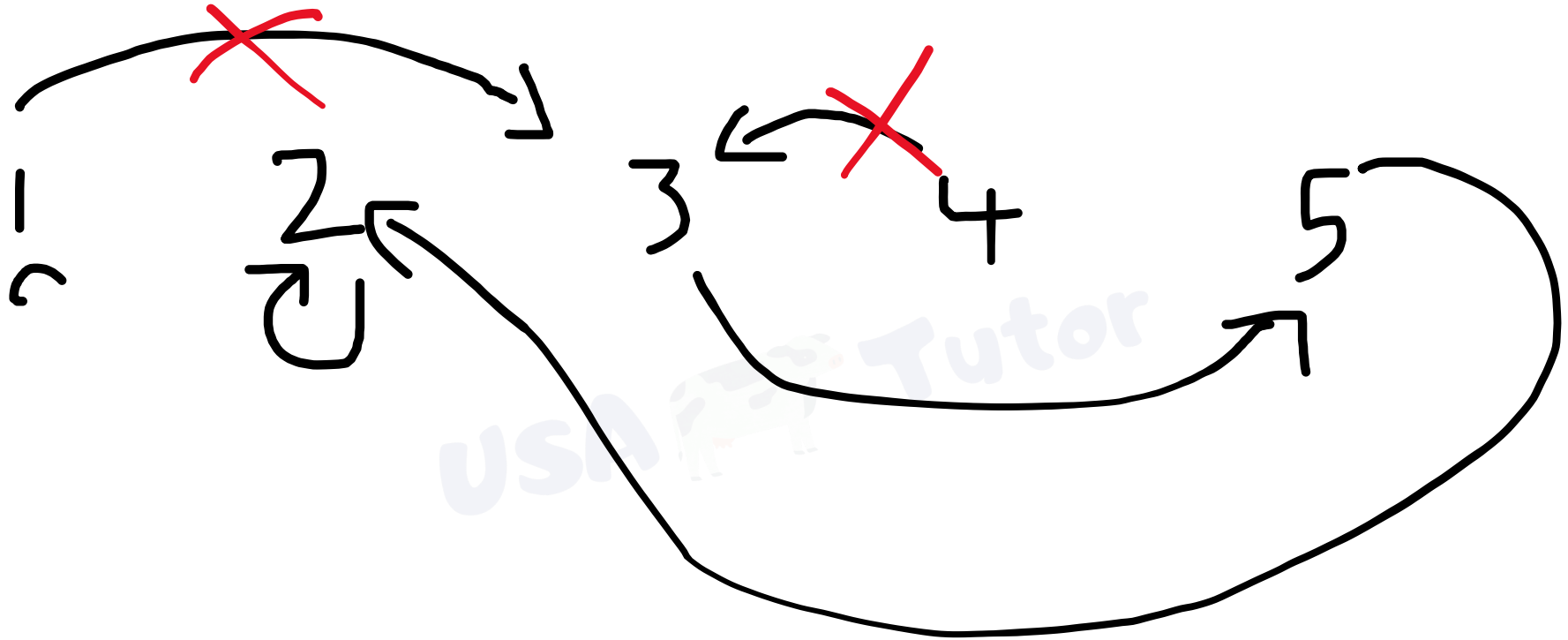

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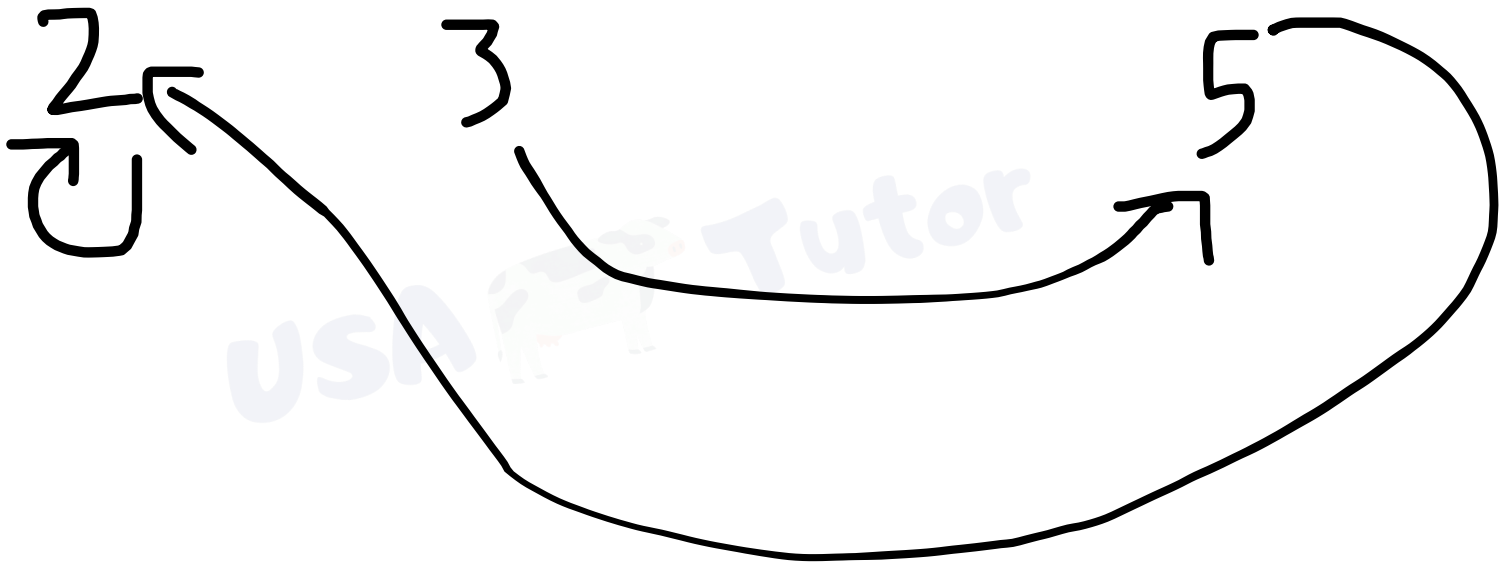

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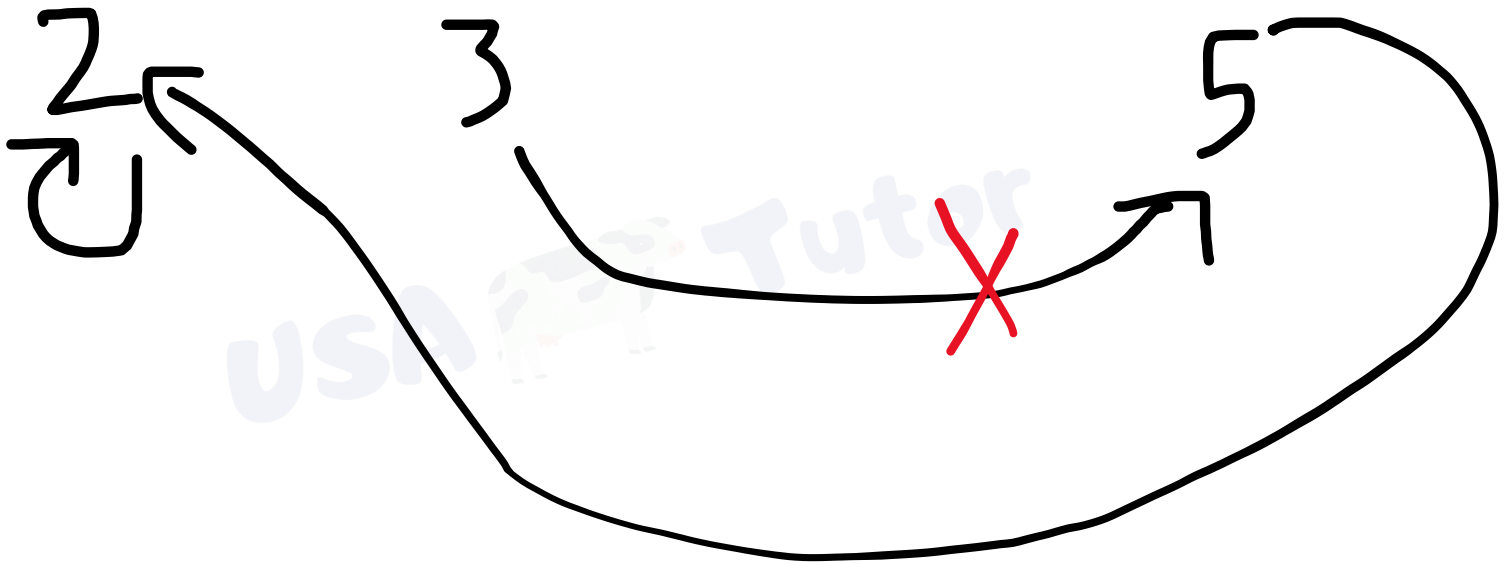
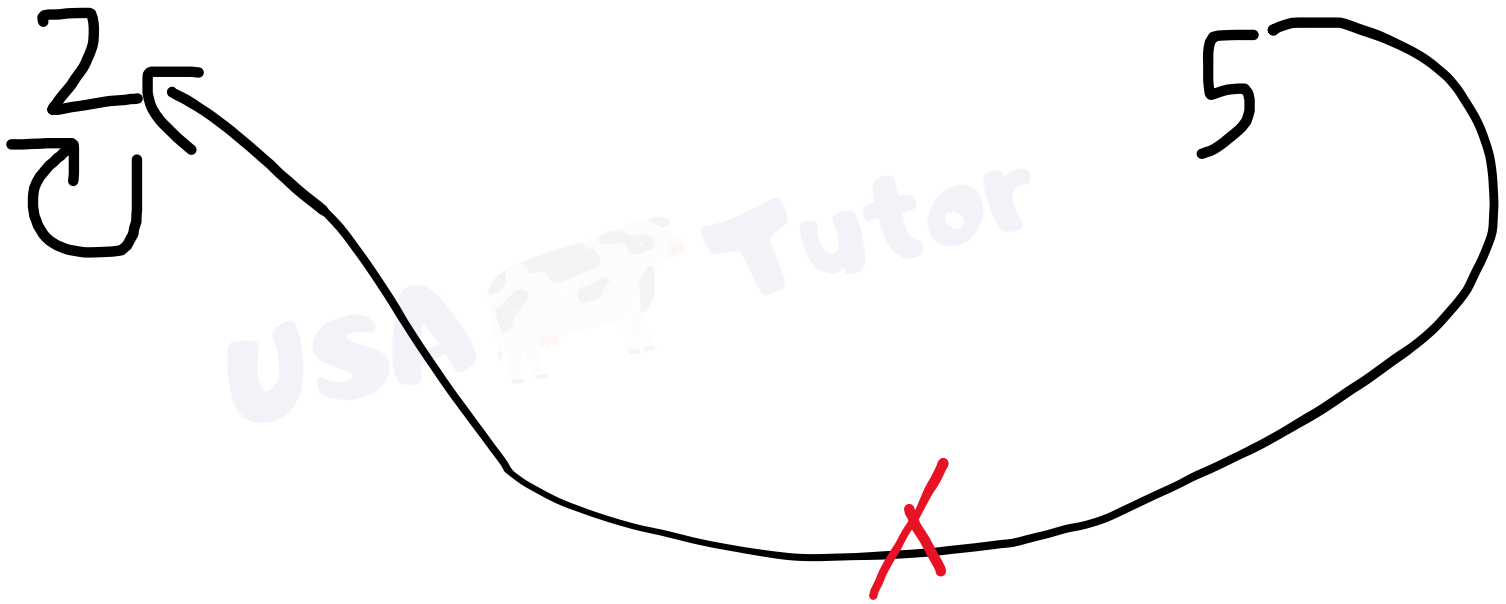


Maybe a better sample



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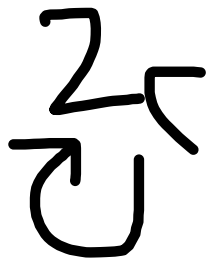


Realizations?

Certain cows get “sucked in”

There are *cycles*

A cycle guarantees there will be cows in that cycle, and there will always be a cow in that cycle.

Self-cycles are allowed.

Realizations

If you are in a cycle, you will be a cemented position

If not you will not be one

How to code?

Coding

Let’s assume we’re NOT in a cycle:

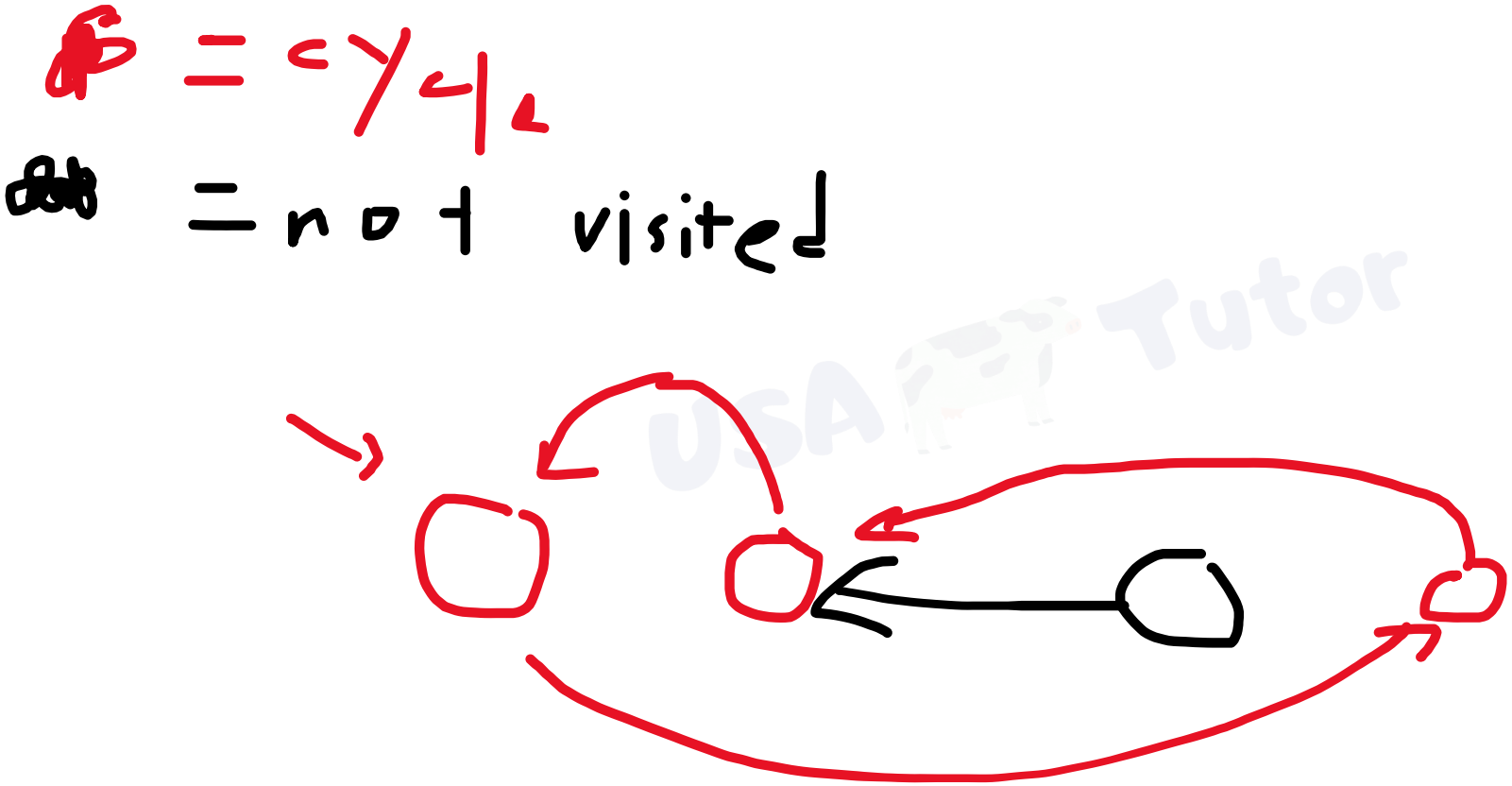
Mark as not cycle

This node does not contribute to answer

The Cycle Case:

How do you even find you are in a cycle?

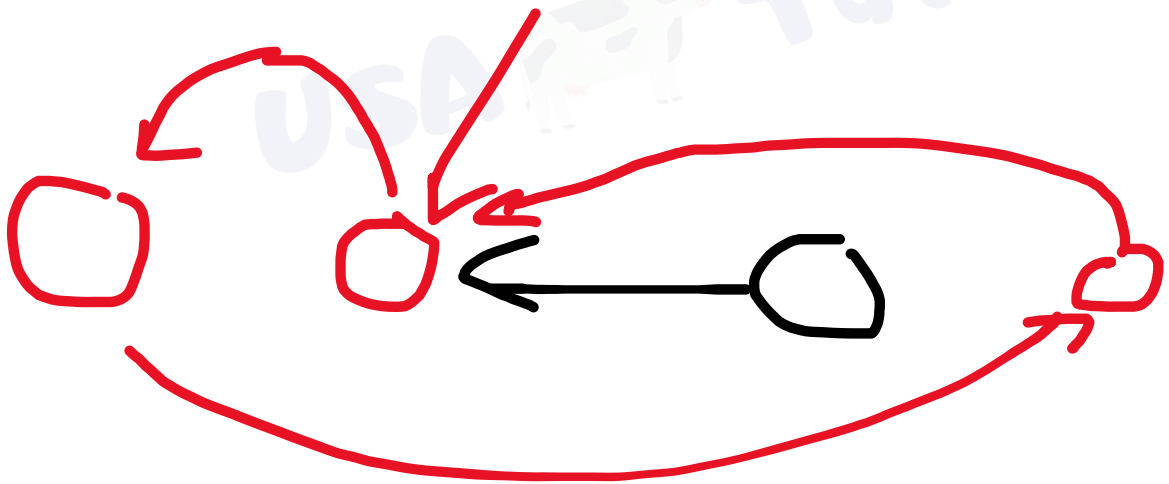
How not in cycle



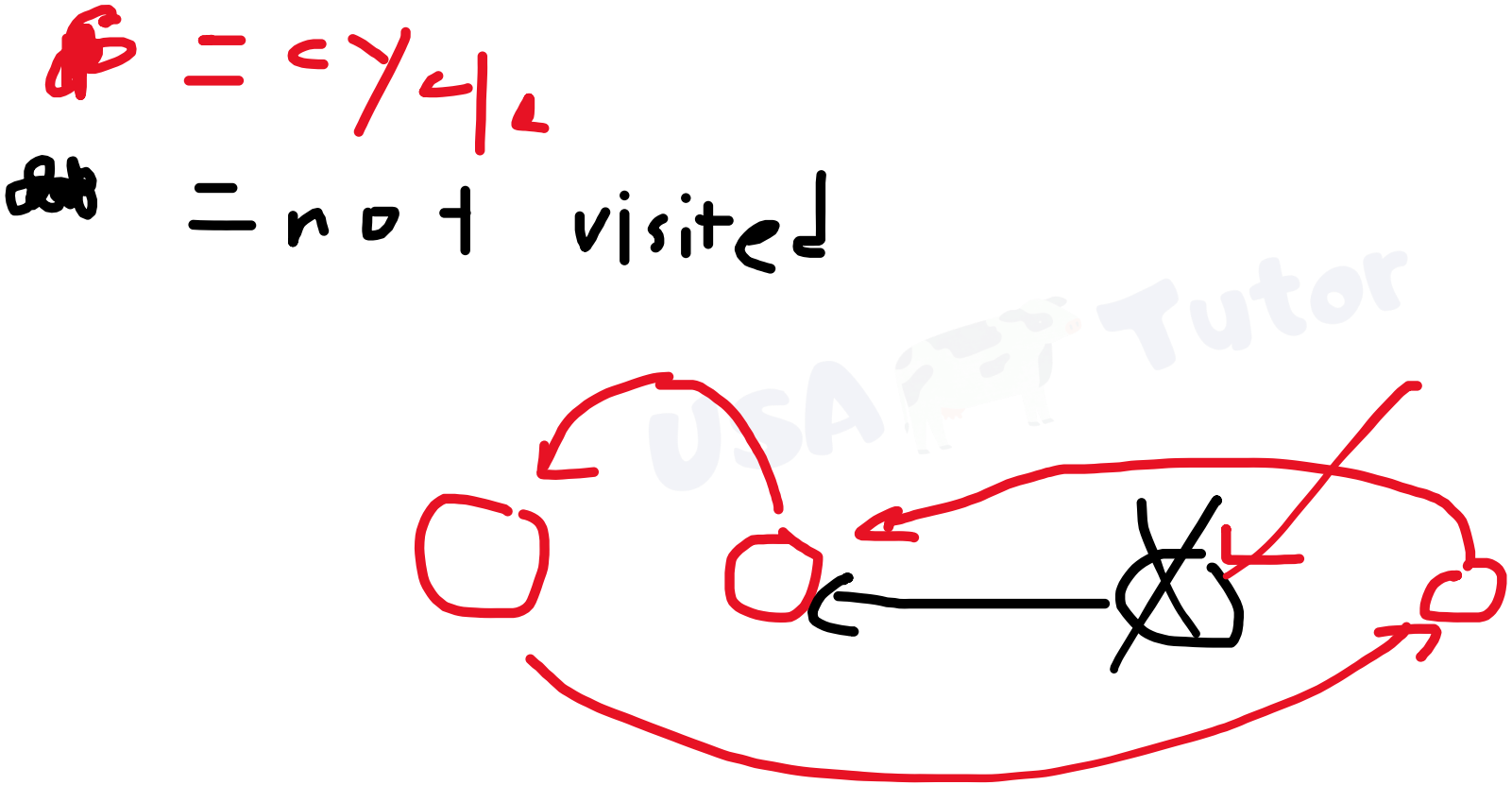
How not in cycle

= cycle

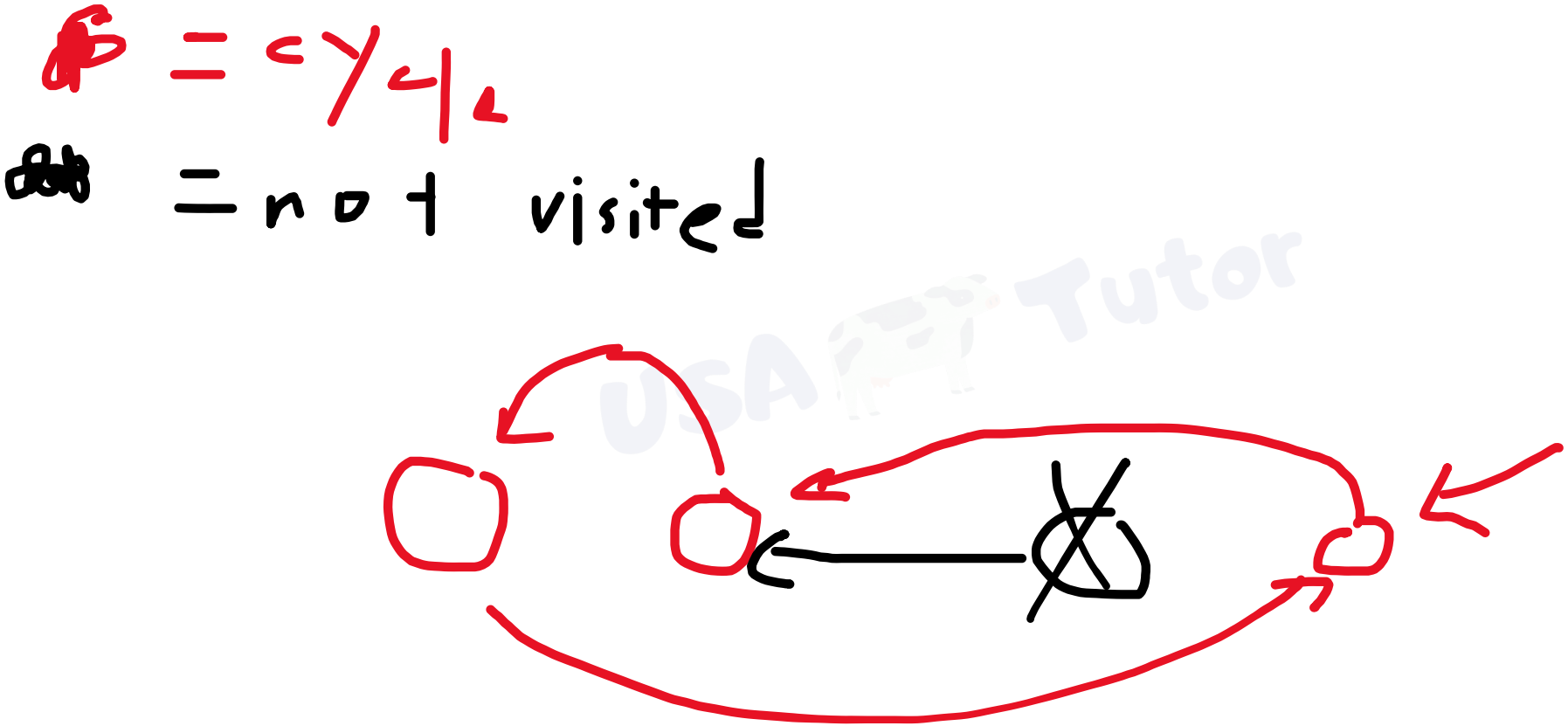
= not visited



How not in cycle



How not in cycle

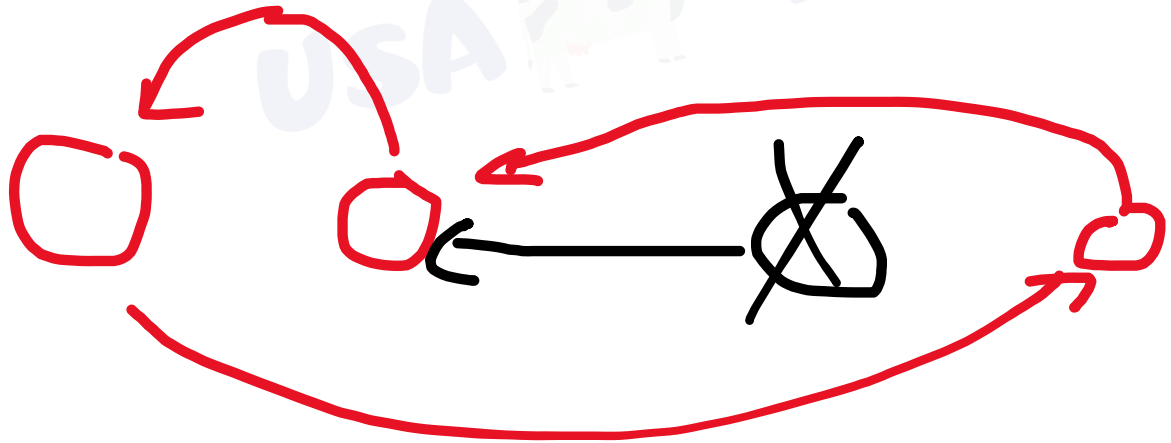


How not in cycle

= cycle

= not visited

gn5 = 3



Coding

The Cycle Case:

How do you even find you are in a cycle?

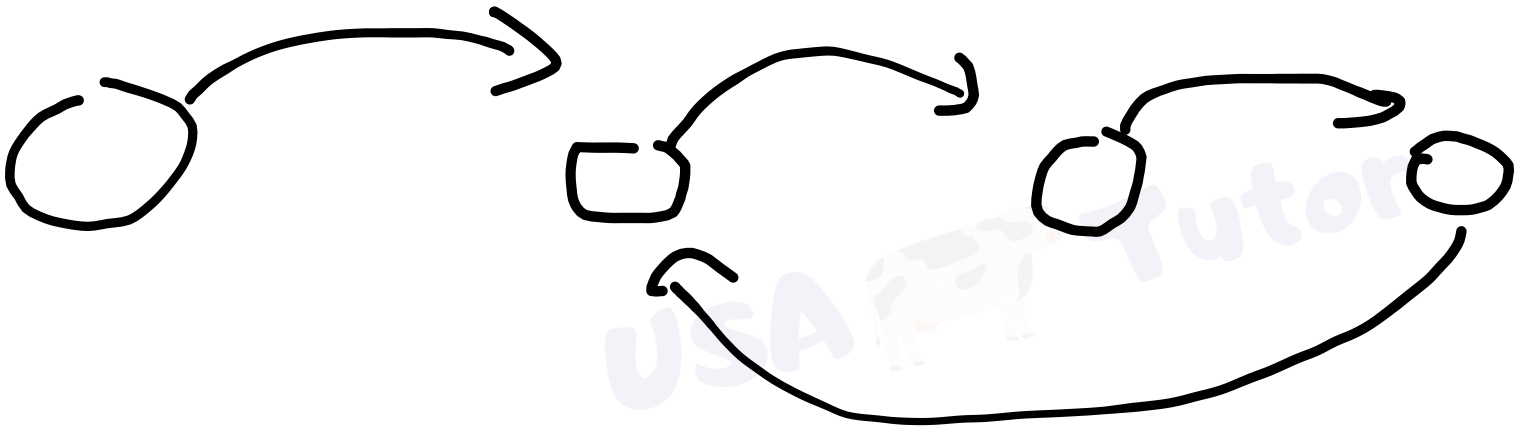
While loop, take 2 pointers (like you did for swapity swap)

Find which nodes are in the cycle and which ones are not

Mark them with their respective values

(0 for not visited, -1 for bad, 1 for good)

Sample that will help coding



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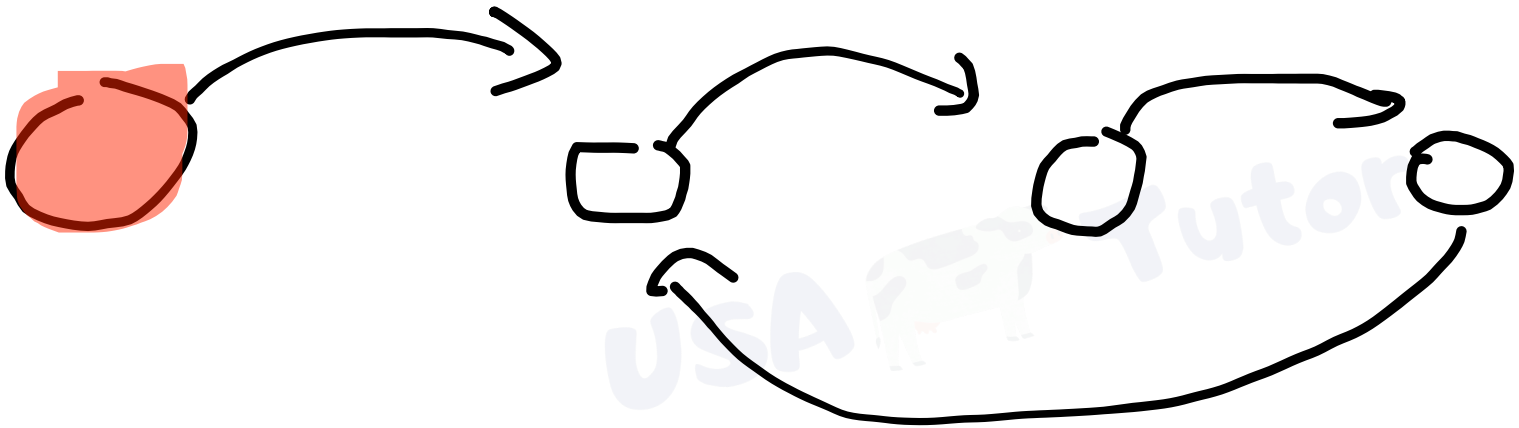

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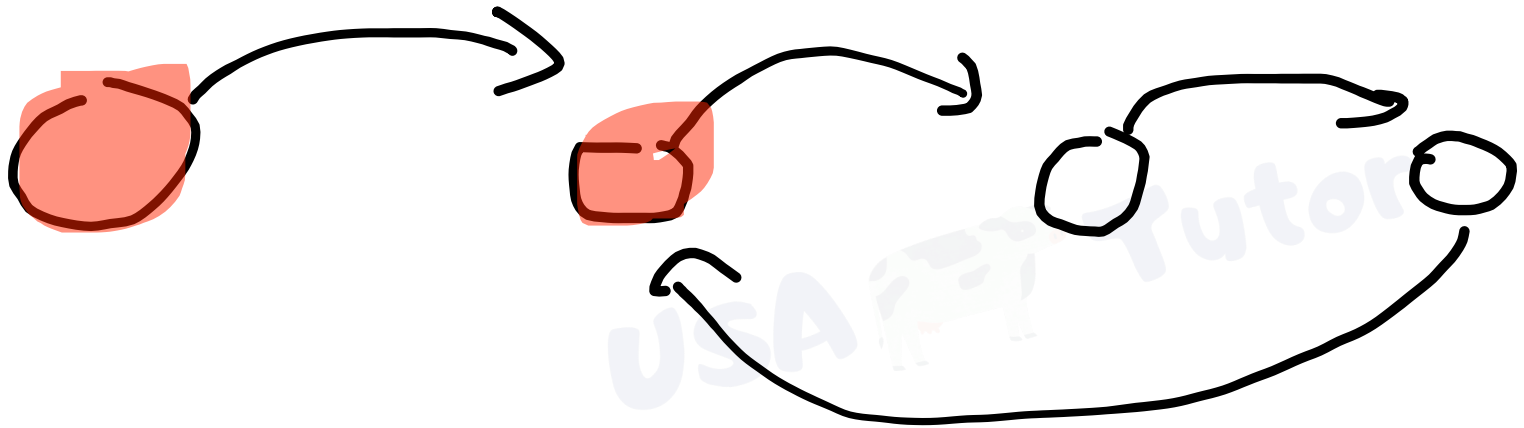
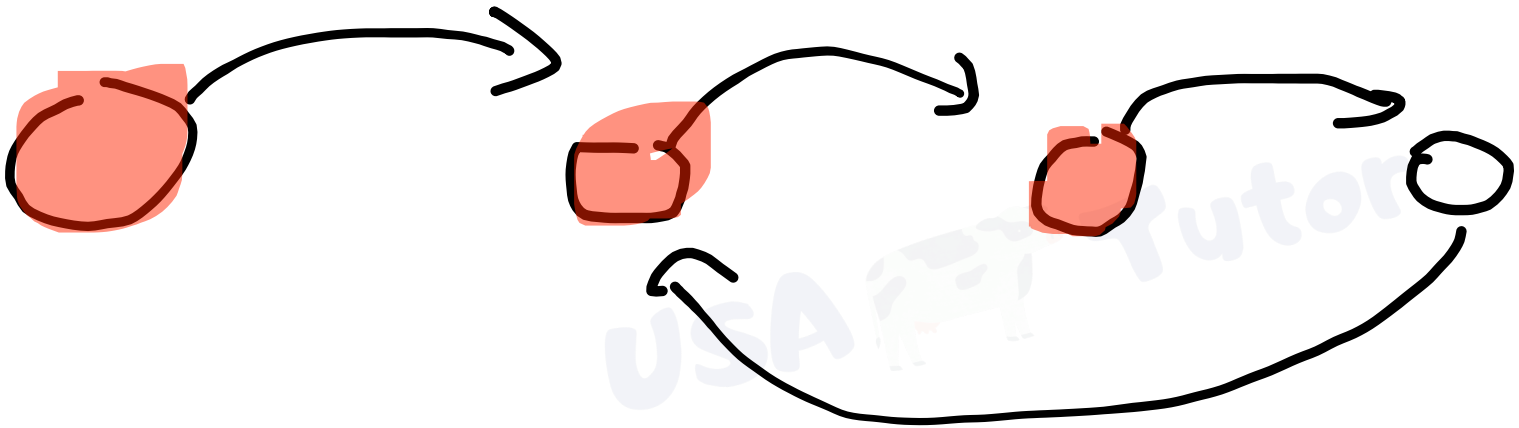


Sample that will help coding



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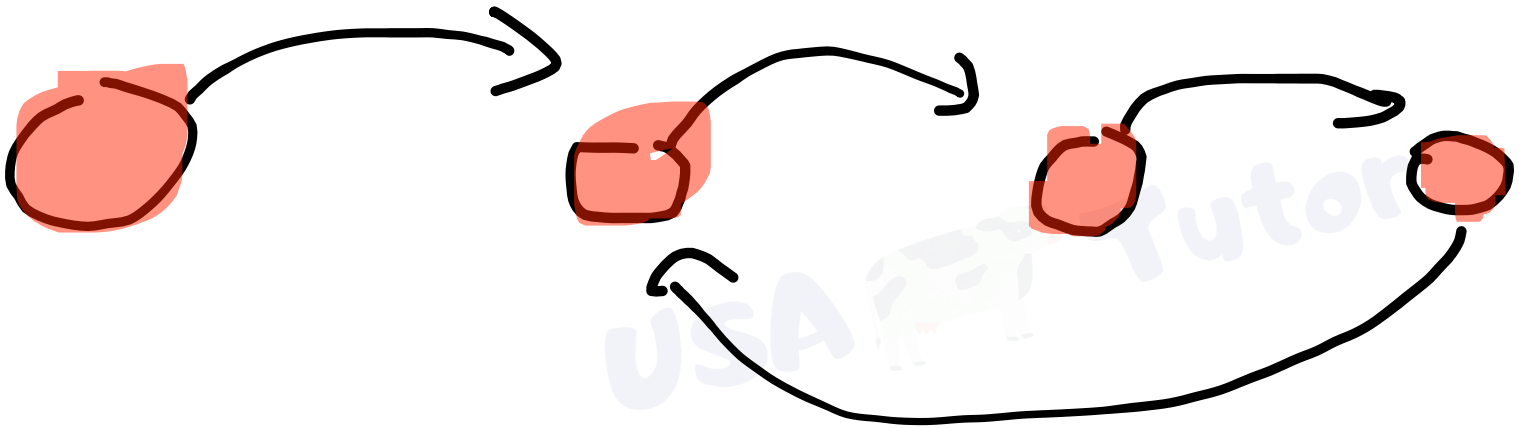

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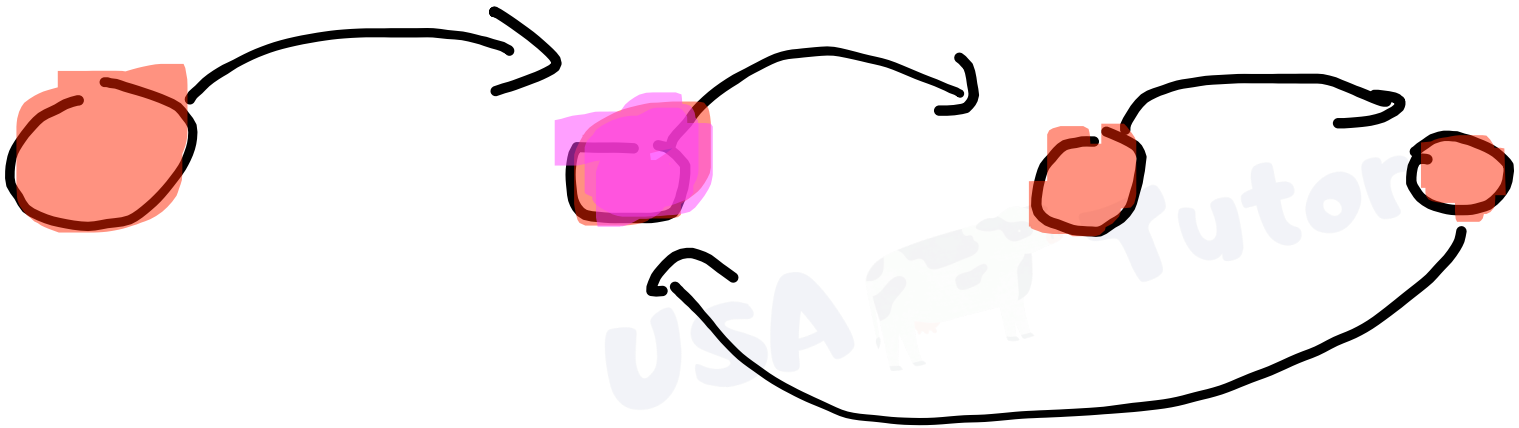


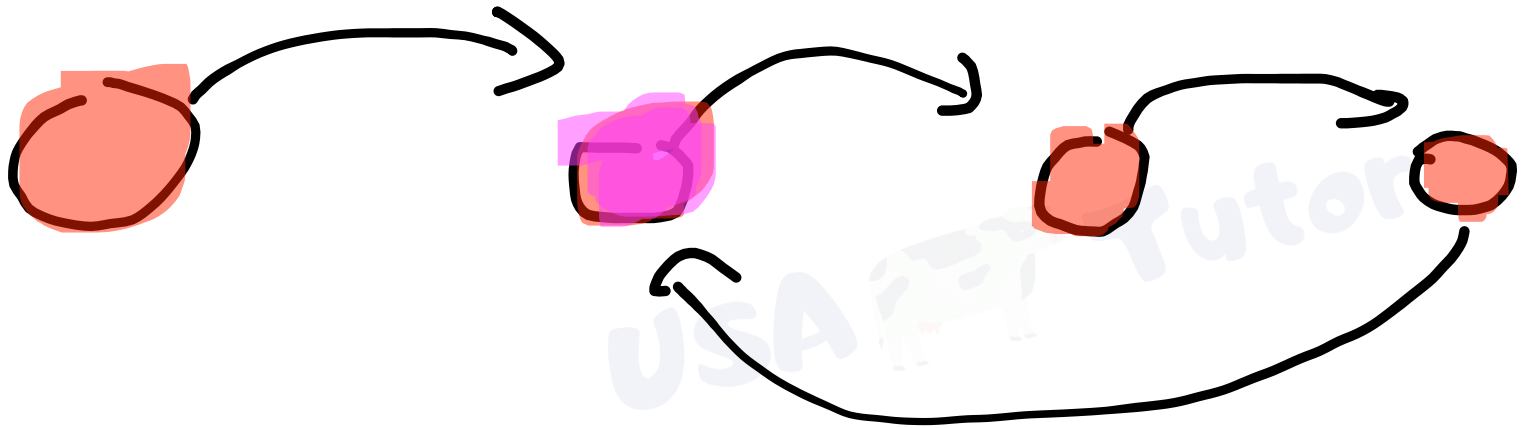
Implementing this “backtrack”

Store the nodes in a traversal into an ArrayDeque or a Stack

An ArrayDeque is a structure that can remove/add nodes from the front and/or the back of the structure in O(1) time.

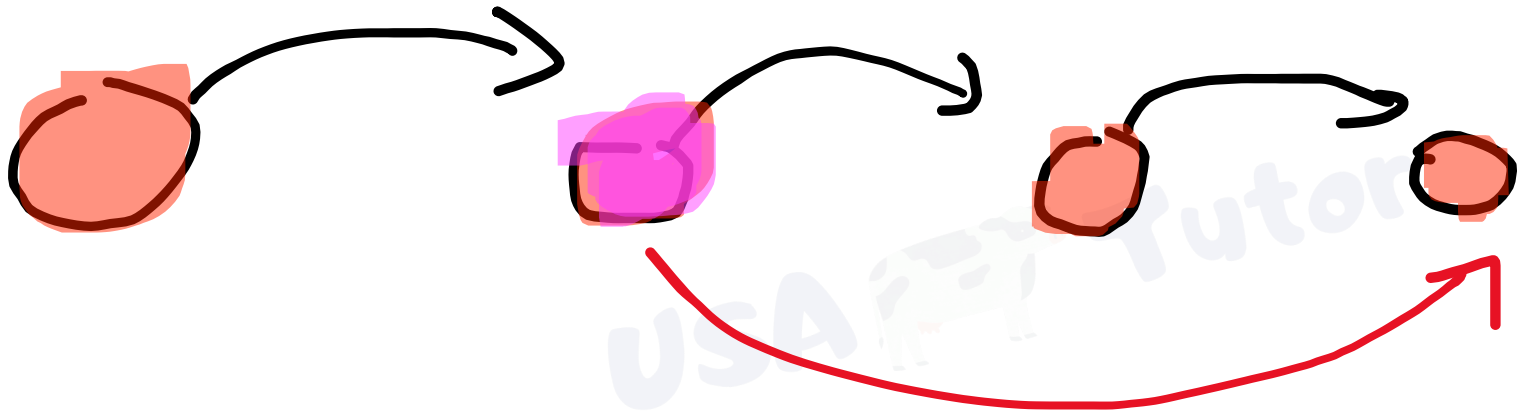
You will pop off every node UNTIL you reach the doubly visited node (highlighted in pink)

Sample that will help coding



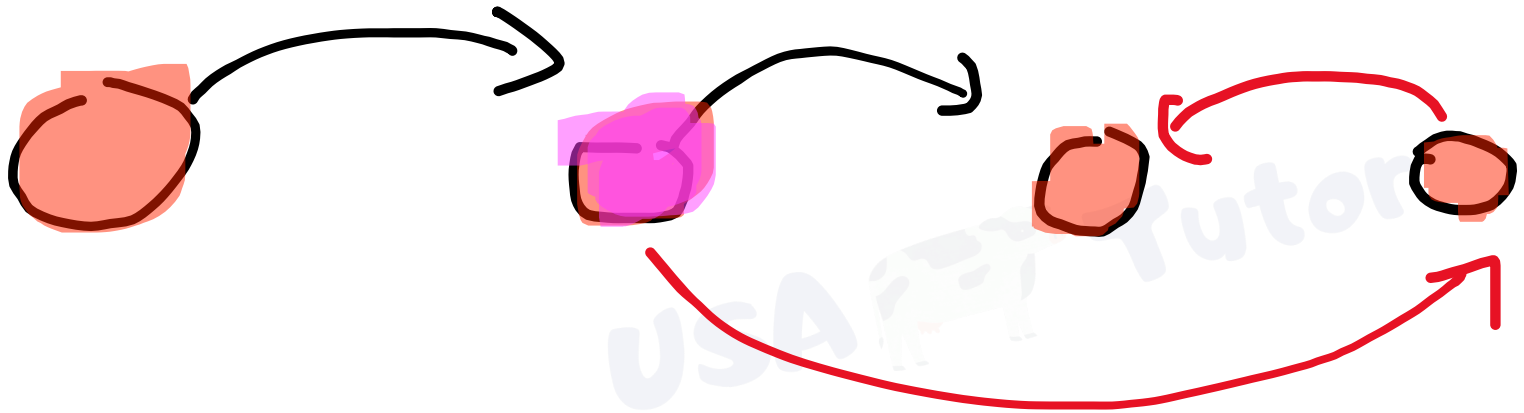
1 2 3 4 2

Backtrack



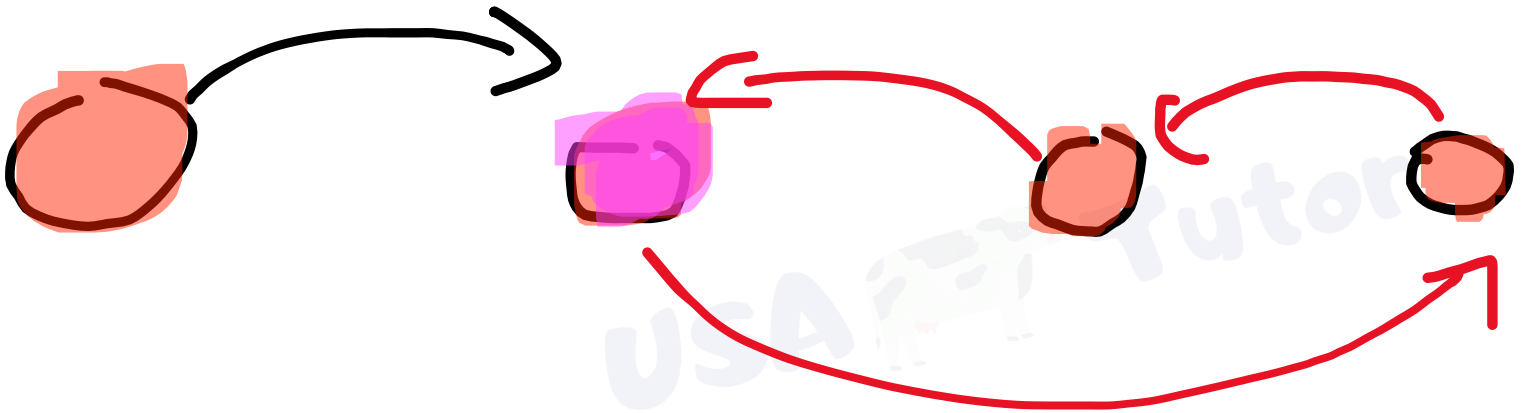
1 2 3 4

Backtrack



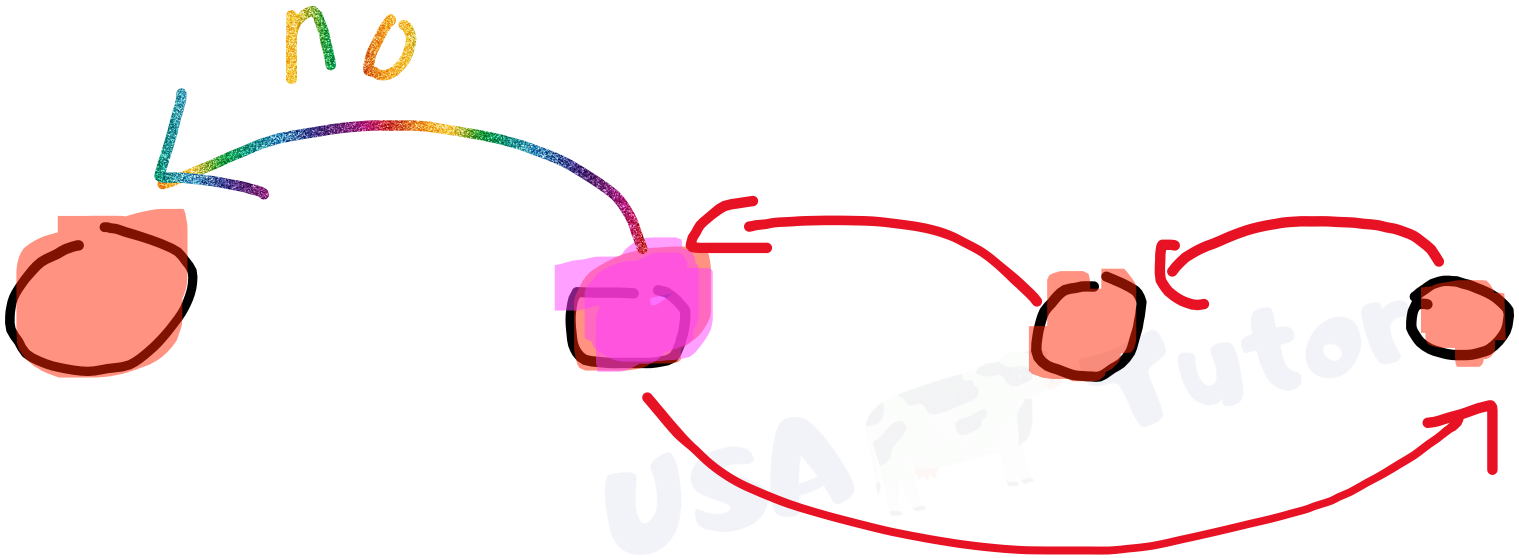
1 2 3

Backtrack



1 2

Backtrack



Coding Tutorial

Code is sent on LMS