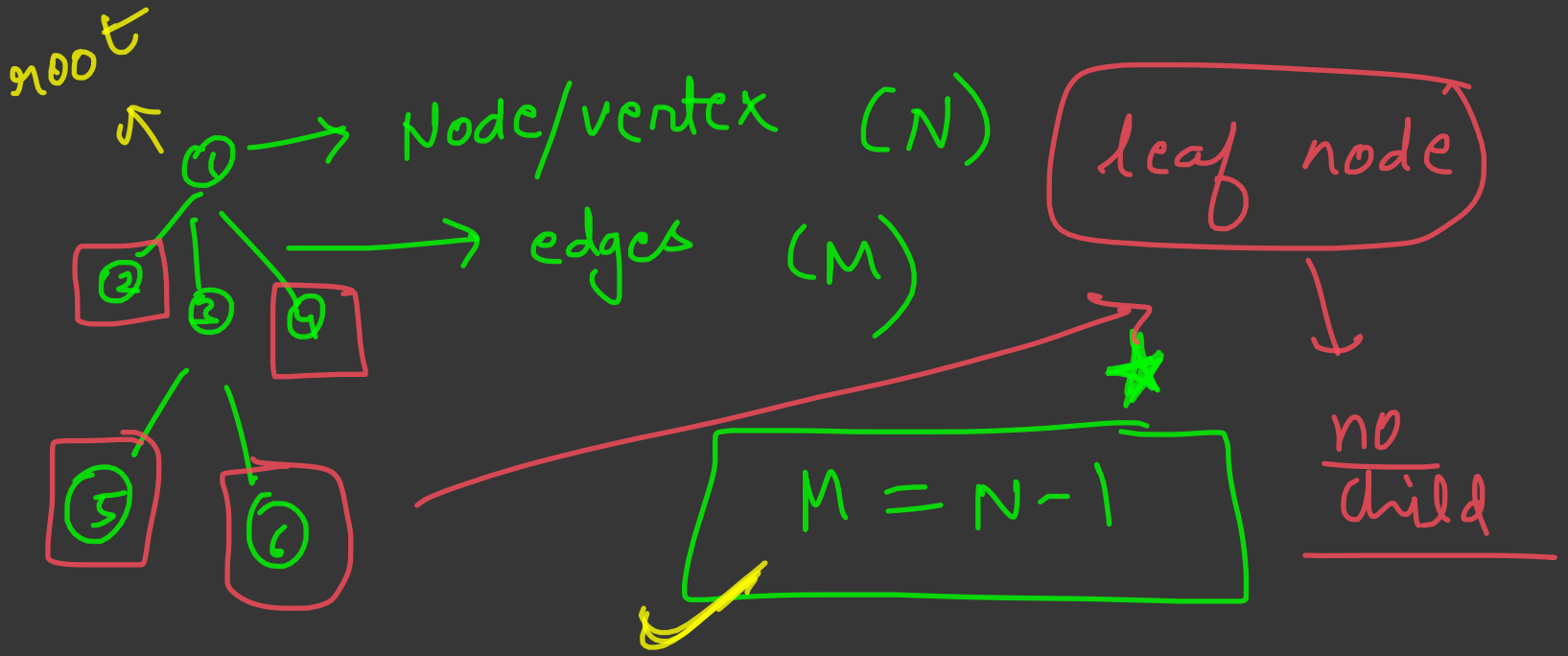
Trees 1 (Introduction)

Dev Karan Singh (devkaran1231)
Expert at codeforces (1817)
5 star at codechef (2040)

Introduction to Trees

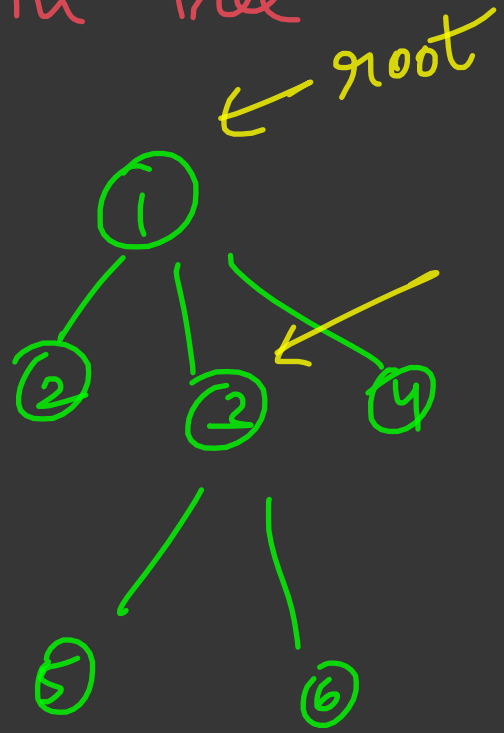
- Basic terminologies in trees
- Properties of trees
- How to store a tree? How will the input be given?
- Traversal techniques in Trees
  - **D**epth **F**irst **S**earch (DFS)
  - **B**readth **F**irst **S**earch (BFS)
- Questions
  - Given a tree, give me the height of the tree
  - Subordinates
  - Given root node and another node x, print path root -> x if exists

generic tree →



N-array tree → each node can have n number of children

→ No cycle in tree



children
↳ 5, 6

parent
↳ 1

Ancestor
↳ 1

Q How to store a tree?
How will be the input given?

N → nodes

N-1 lines

Eg:

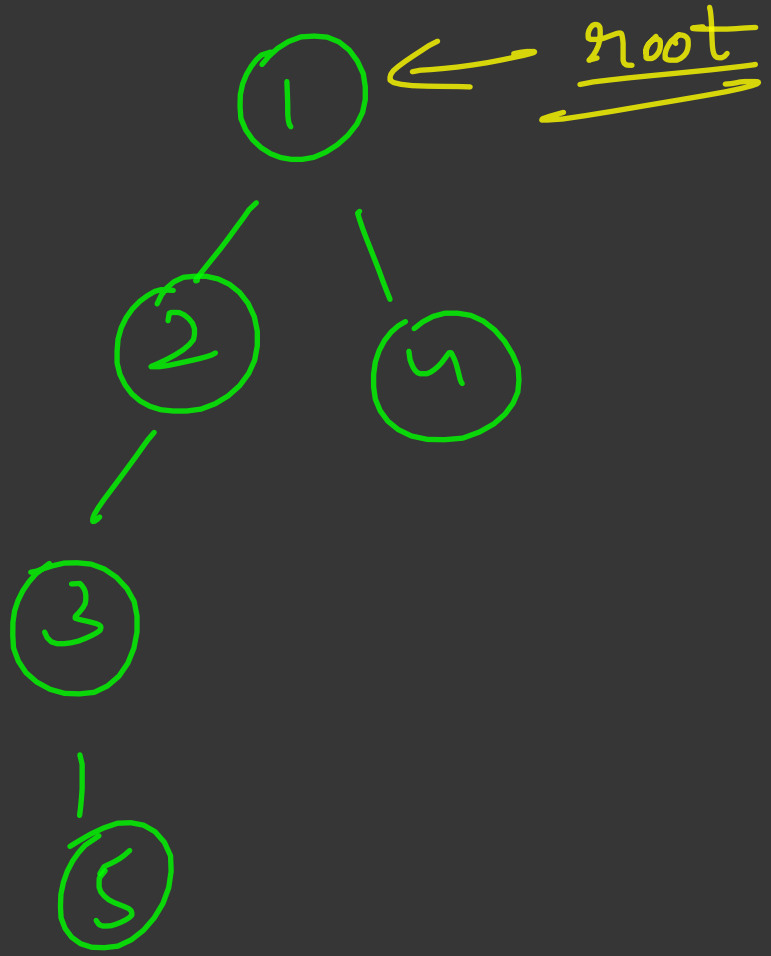
5

1 2

2 3

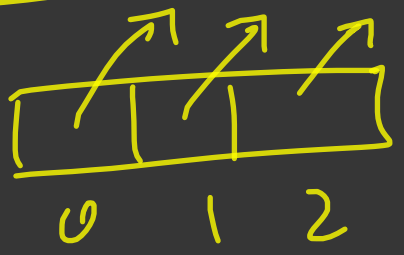
1 4

3 5

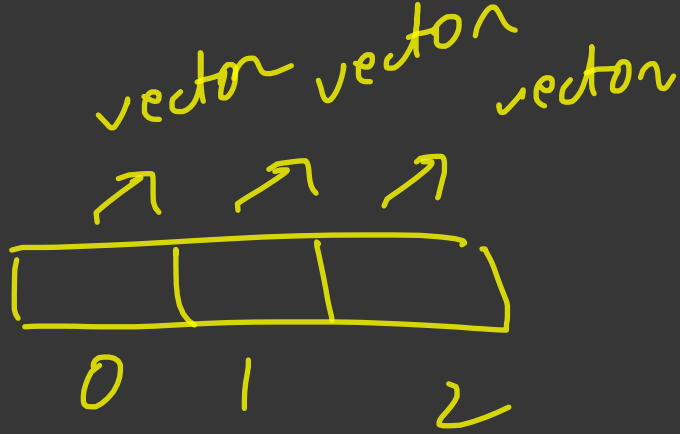


int an[n+1];

n = 2



vector<int> an[n+1];



5

1 2

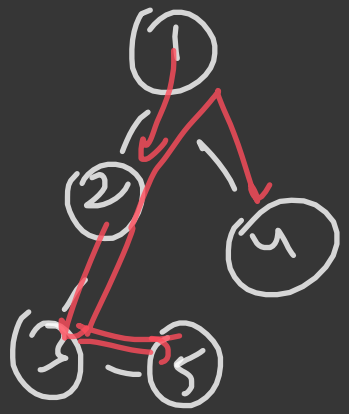
2 3

1 4

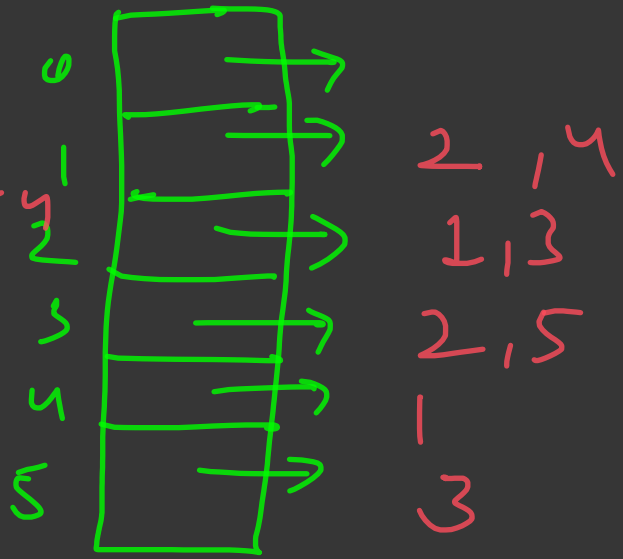
3 5

adj list

vector<int> adj[6]



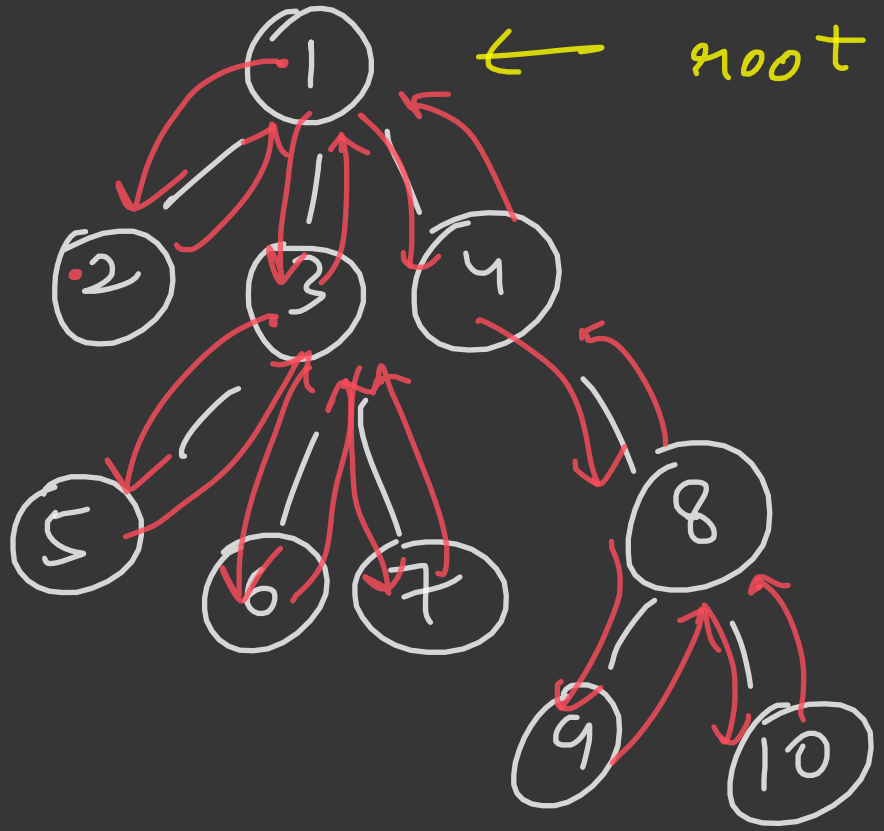
1 2 3 5 4



Traversal → DFS → Depth first search

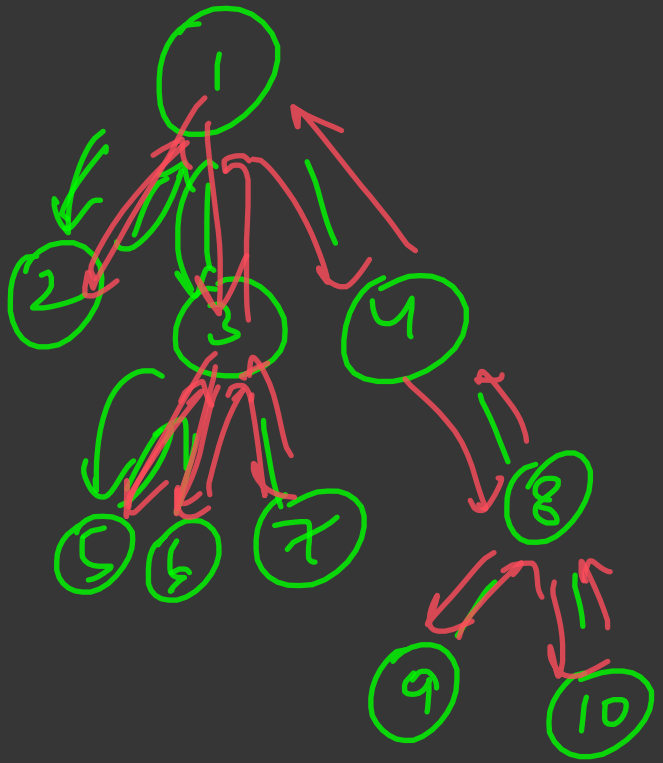
Traversal → BFS → Breadth first search

① DFS → Depth first search



→ code can be a recursive one

node, adj, par

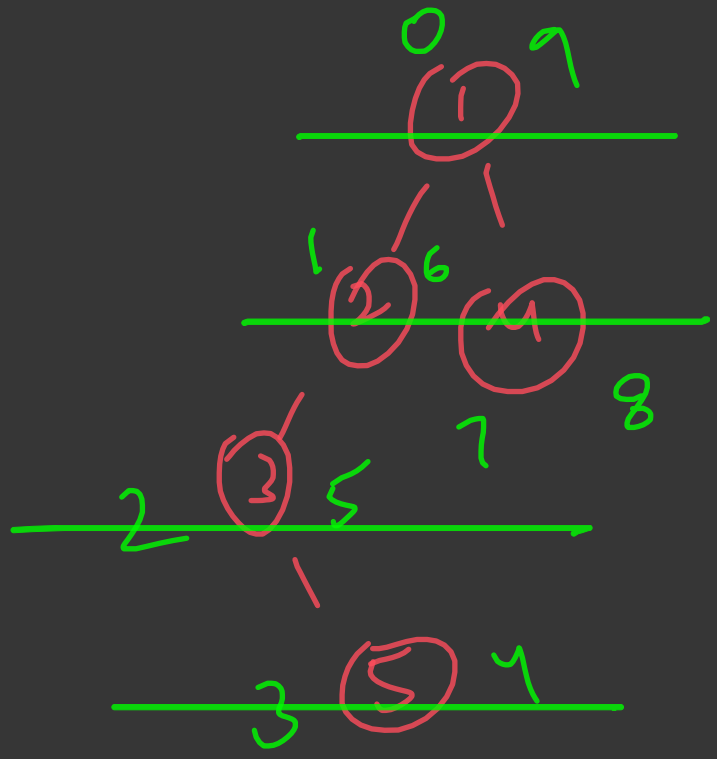


1 → [2, 3, 4]

3 → [1, 5, 6, 7]

5 → [3]

1 2 3 5 6 7 4 8 9 10



$n \rightarrow 10^5$
$q \rightarrow 10^5$
q queries

u v

check if u is anc. of v or not

u → 2

v → 5

→ $in_u < in_v < out_v < out_u$

(2) BFS (Breadth first search)

→ finish one level and then move to next

9 10

d ≡ given a tree, tell me the height of the tree.

Q

subtree[4] = 1

subtree[2] = 2

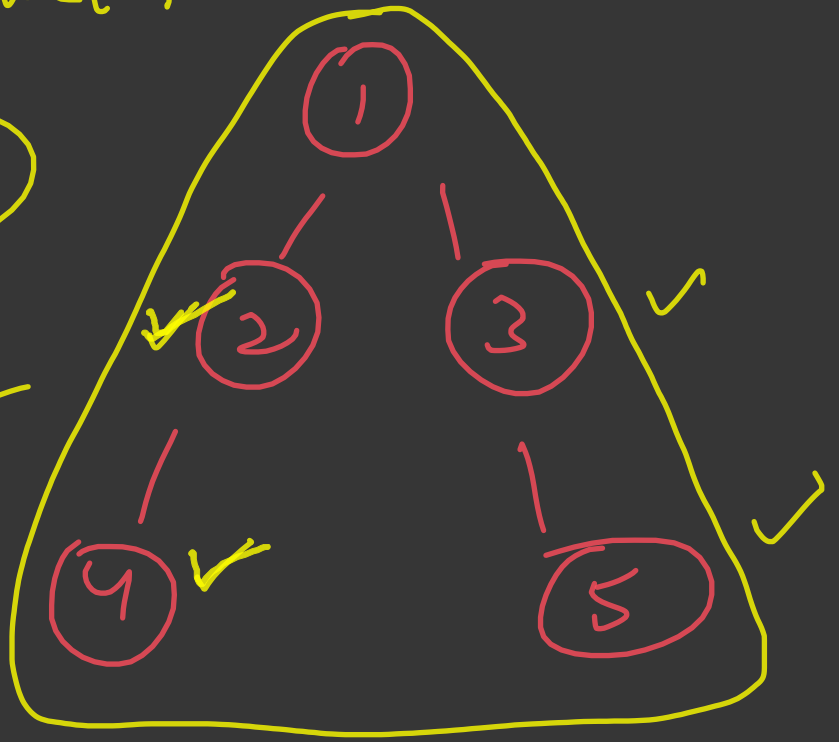
subtree[1] → 5

↓ 1+

subtree[2] → 2

+

subtree[3] → 2



dp →

1	5	2	2	1	1
0	1	2	3	4	5

4 1 1 0 0