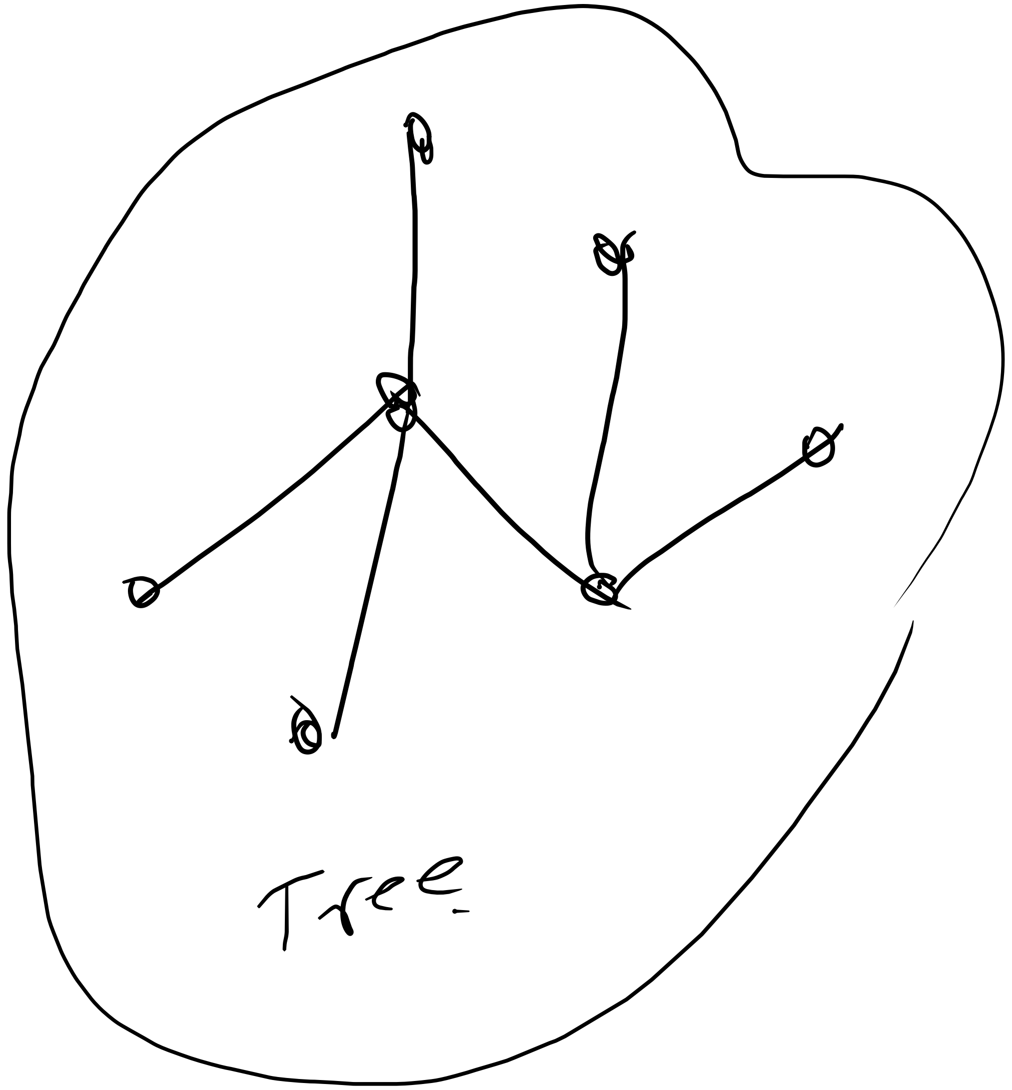
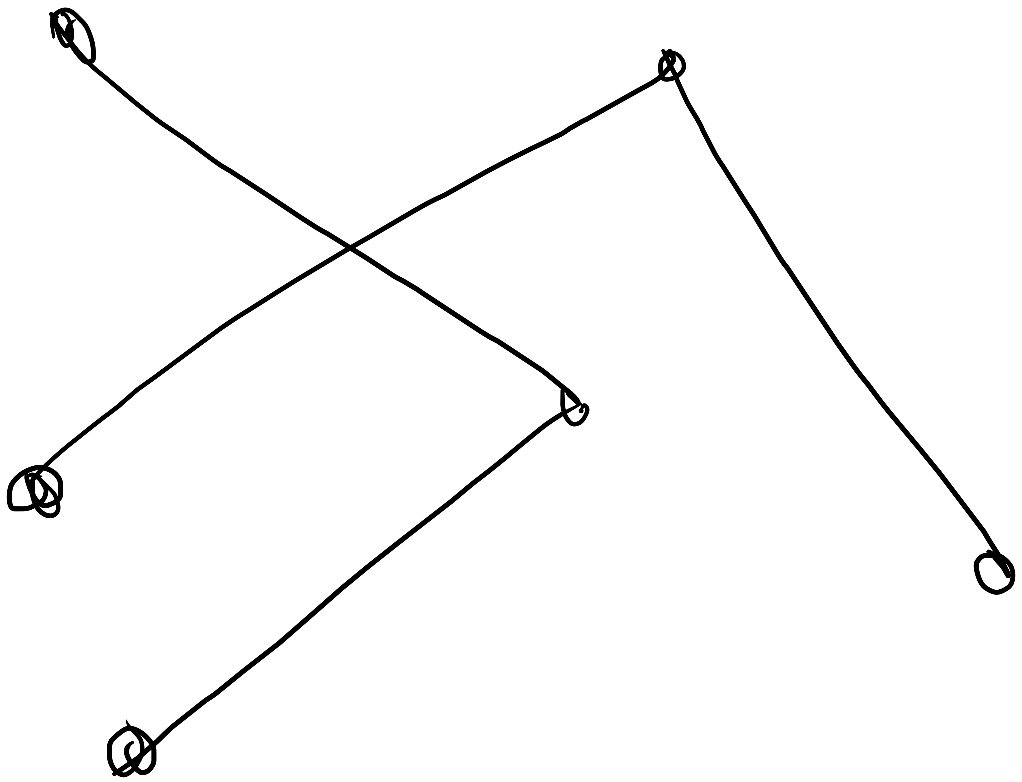
Trees

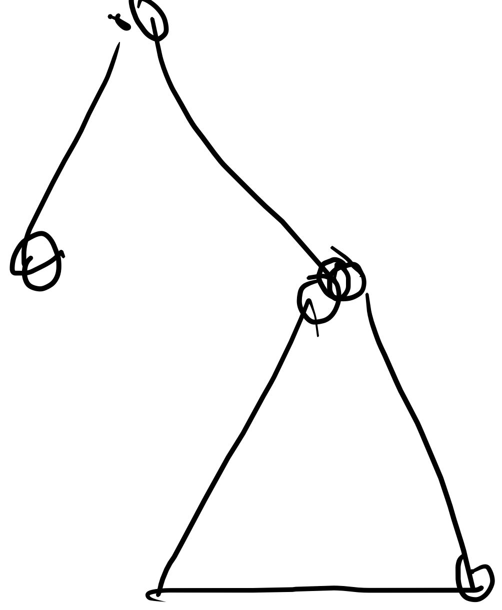
$G(V, E)$

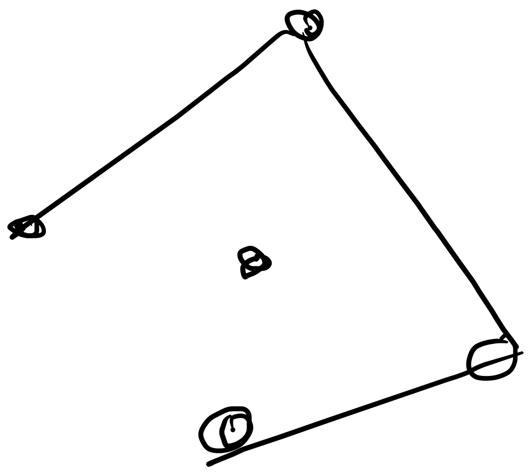
Tree: A tree is a connected undirected acyclic graph.



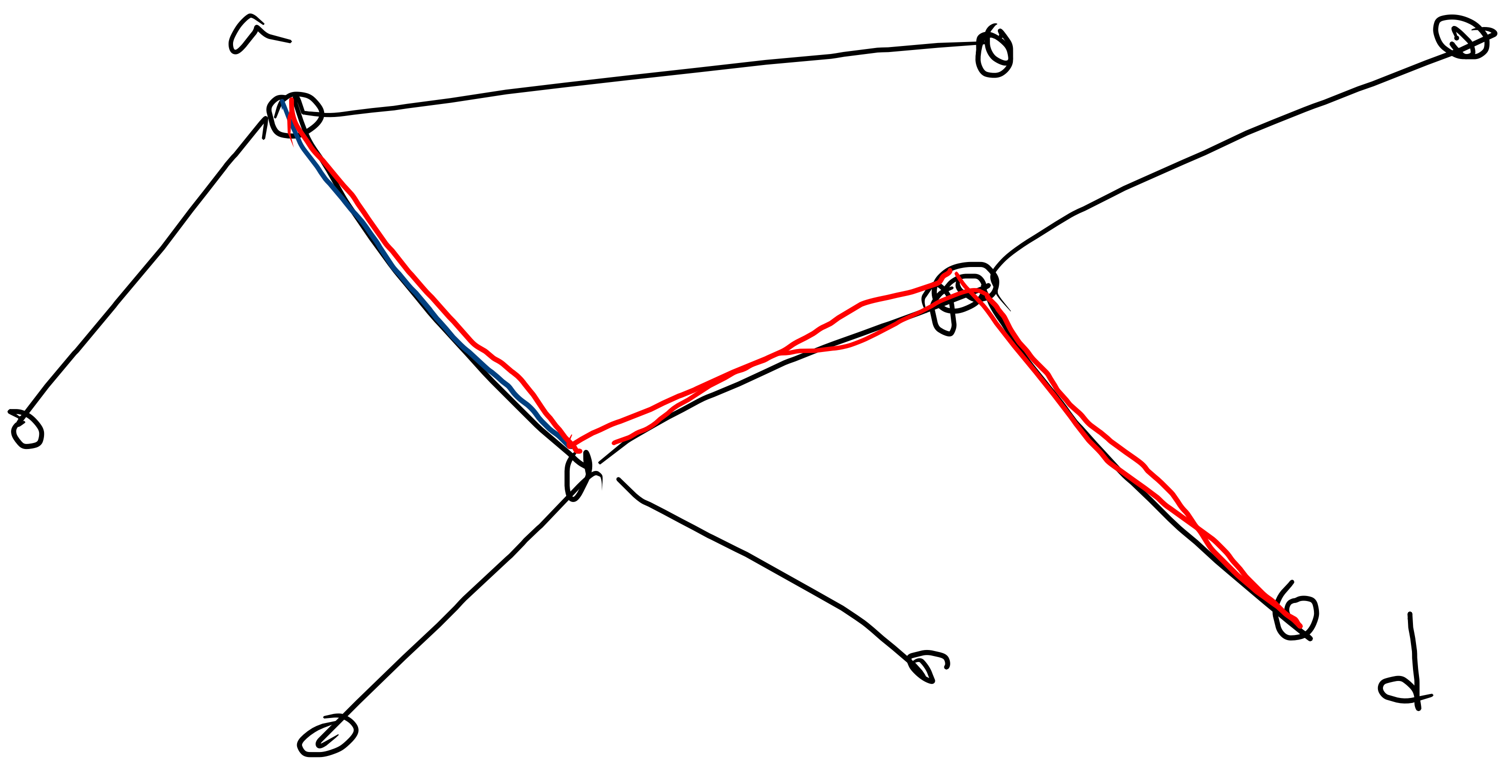


not a tree





Result: A simple undirected graph is a tree iff there is a unique simple path between each pair of vertices.



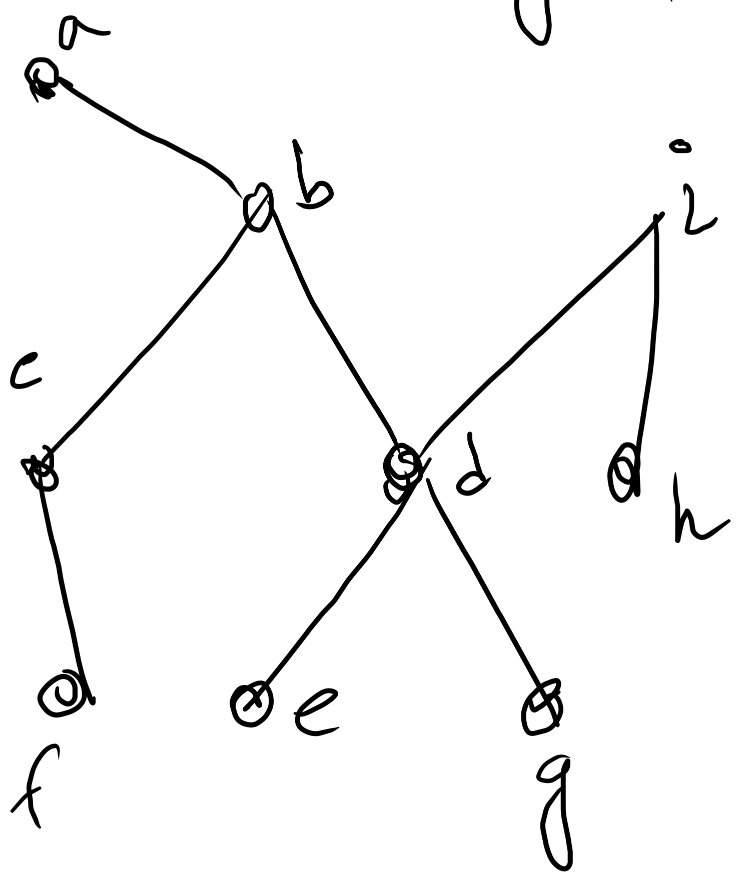
Forest

collection of trees.

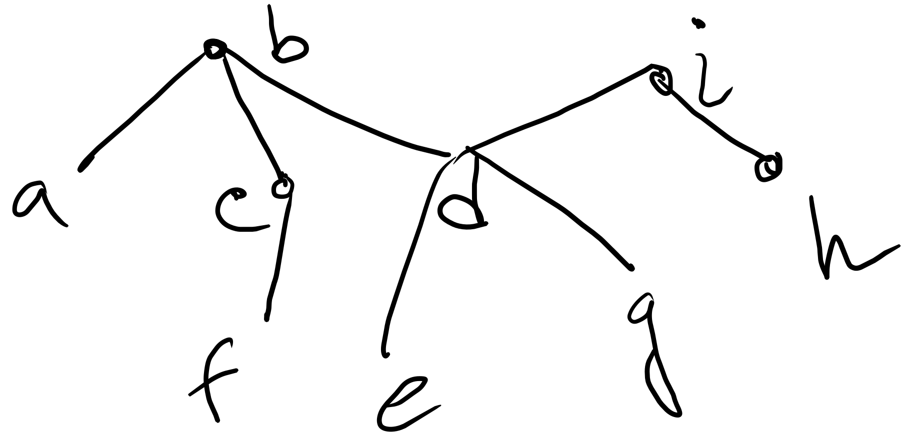
Rooted tree

It is a tree in which there is a vertex designated as the root and every vertex is directed away from the root.

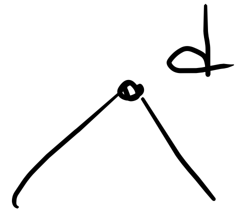
implicit.



consider b as a root.



consider d as a root.



Tree terminologies

(T, r) ← tree T rooted at r.

Parent: The parent of a vertex b (other than the root) is a vertex a such that (a, b) is a implicit directed edge in the rooted tree

Child: b is called the child of a.

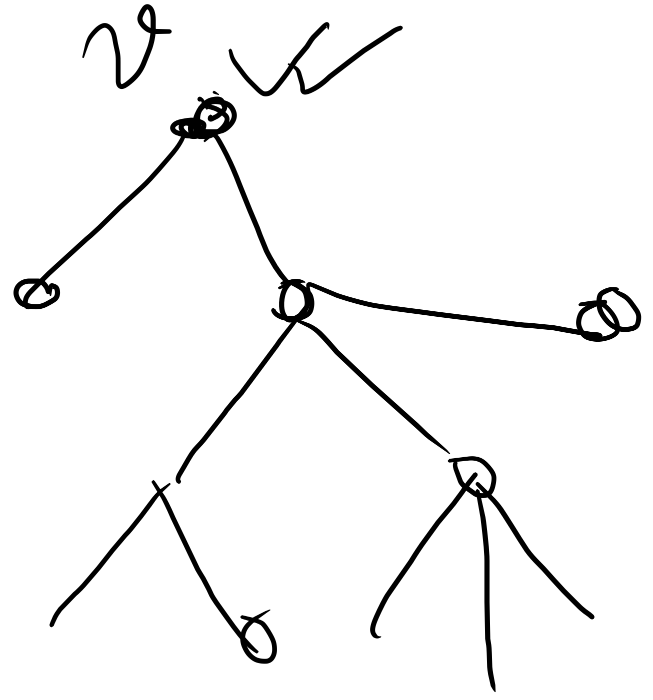
Sibling: children of the same parent.

Ancestor: parent, grand parent, grand grand parent, - - - r

Internal vertices: vertices that have at least one child.

Leaves: vertices that have no child.

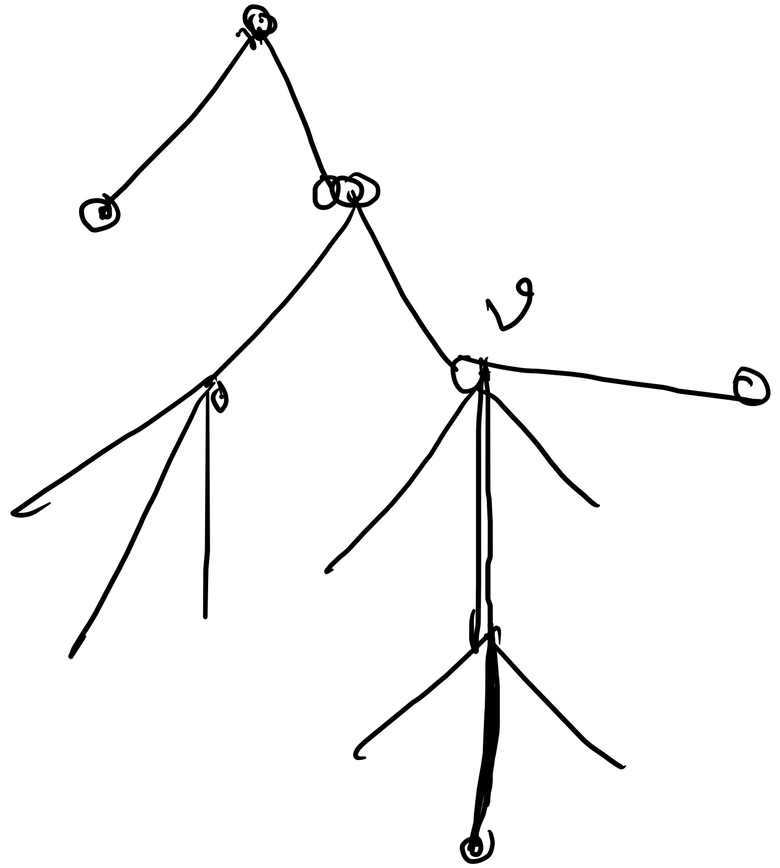
Descendents: of a vertex v is the vertices that have v as an ancestor.



Depth: # ancestors.

depth(v) = 2

height(v) = 2



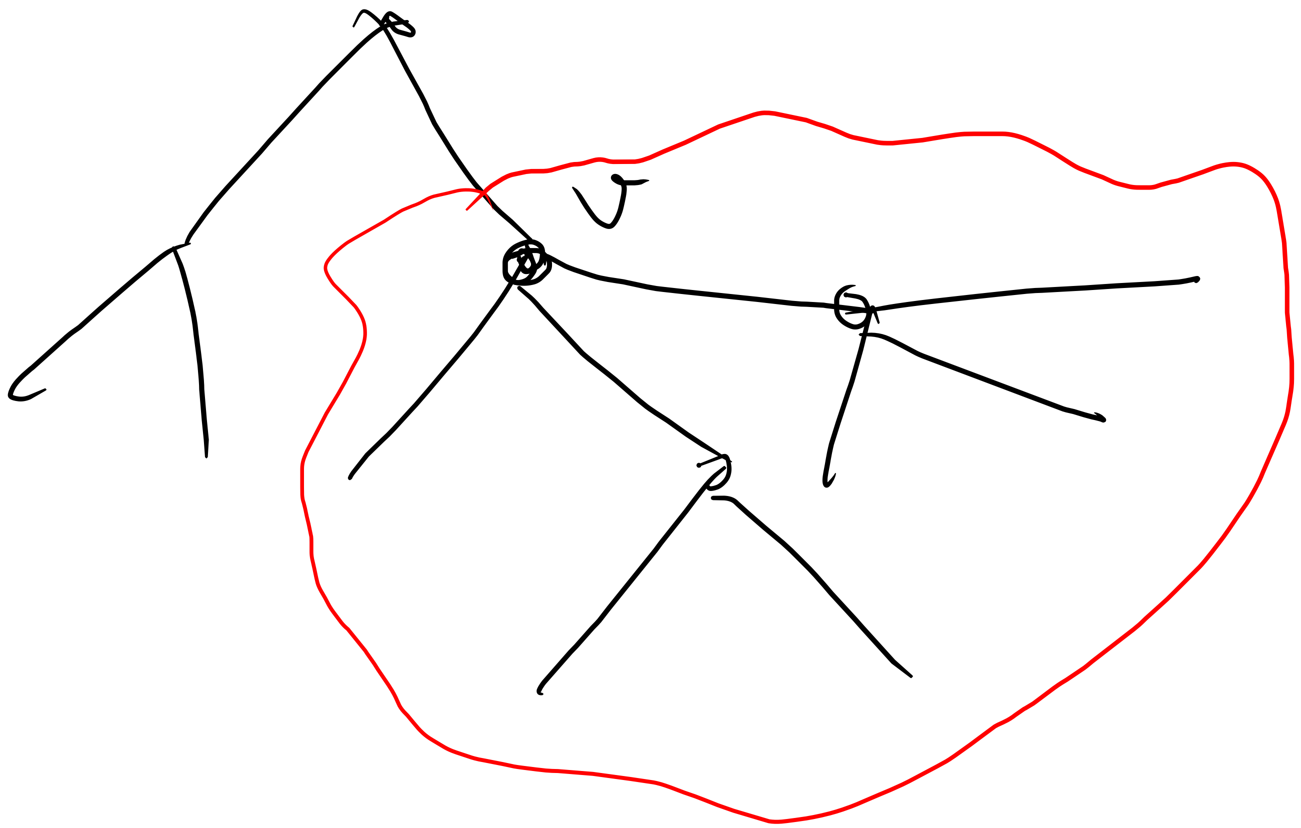
Height of a node: The maximum depth from the node to a leaf.

Height of a tree:

The height of the root of the tree.

Subtree:

Subtree of a tree T rooted at some node v is the tree considering v as the root and all its descendents in T.



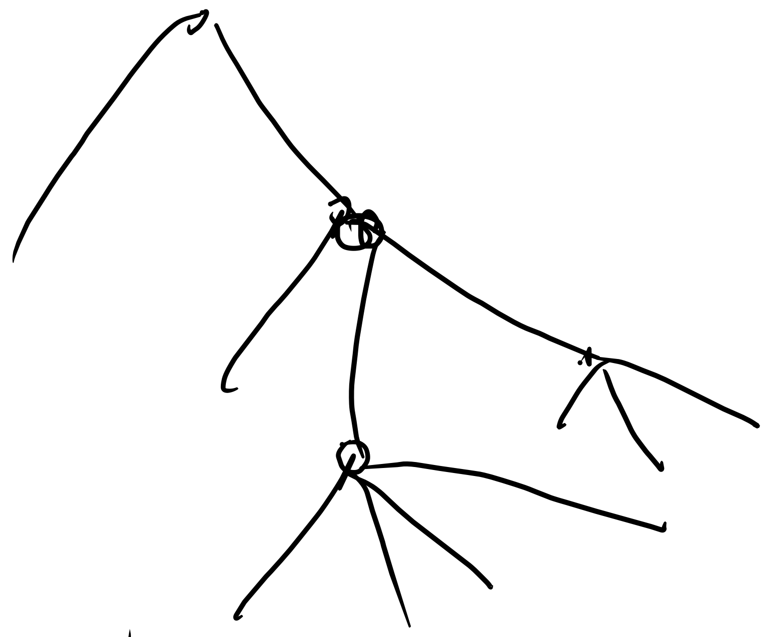
Result: A tree with n vertices has $n-1$ edges.

Degree of a vertex : # children of that vertex.

↓ rooted tree.

Degree of a tree : maximum degree of any vertex.

m-ary tree : Every internal vertex has at most m children.



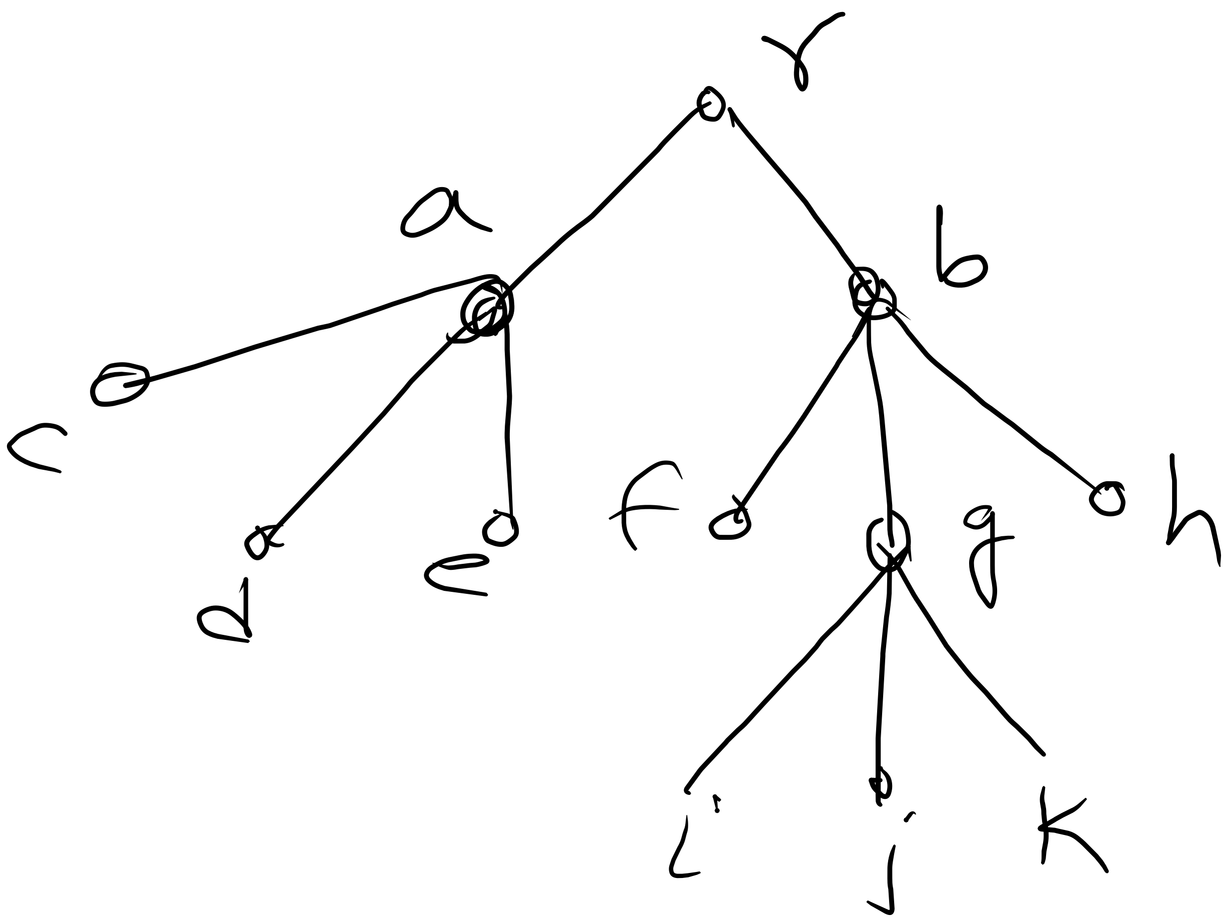
4-ary tree.

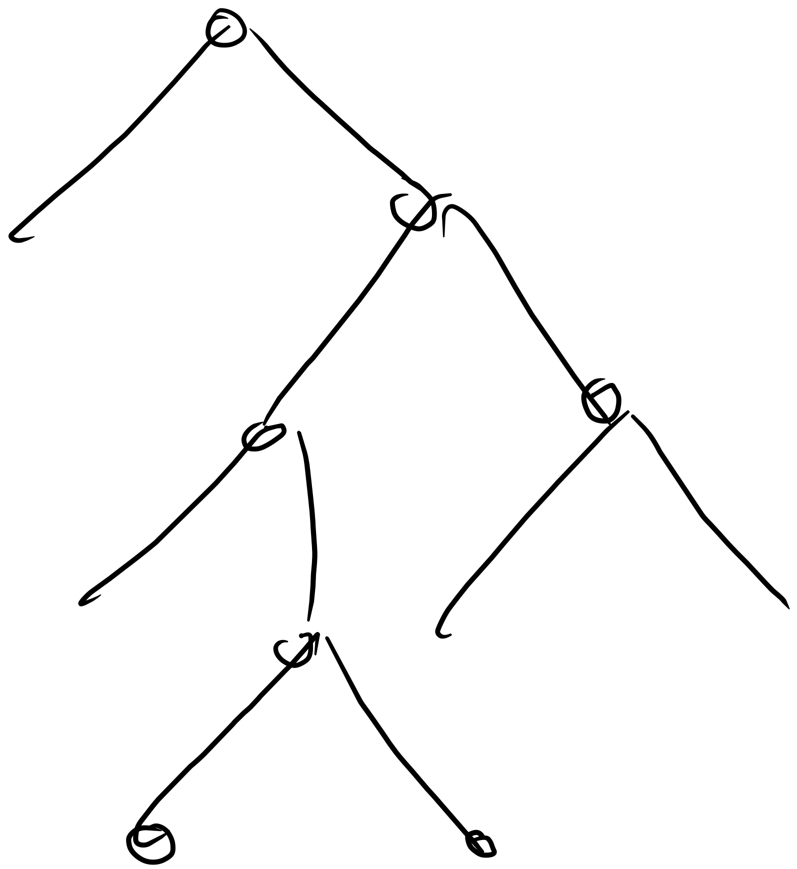
when $m = 2$

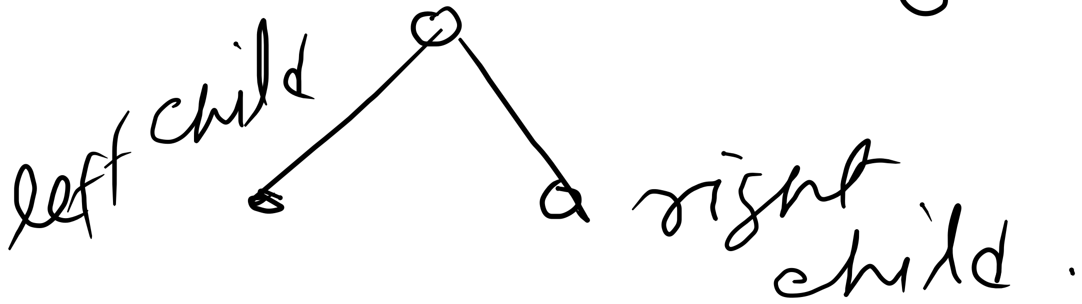
binary tree.

ordered tree

A rooted tree inwhich the set of children of each vertex is assigned a total order.







Tree traversal:

A procedure to systematically visit each vertex of a tree.

most common

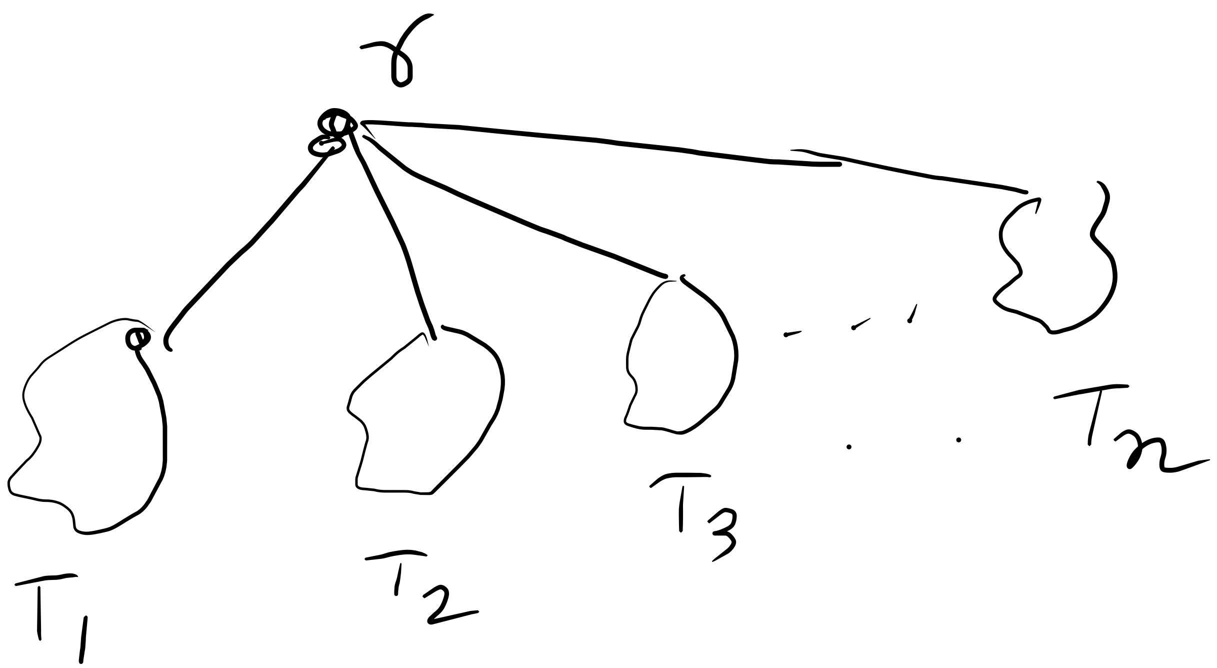
Three traversals

1. Preorder

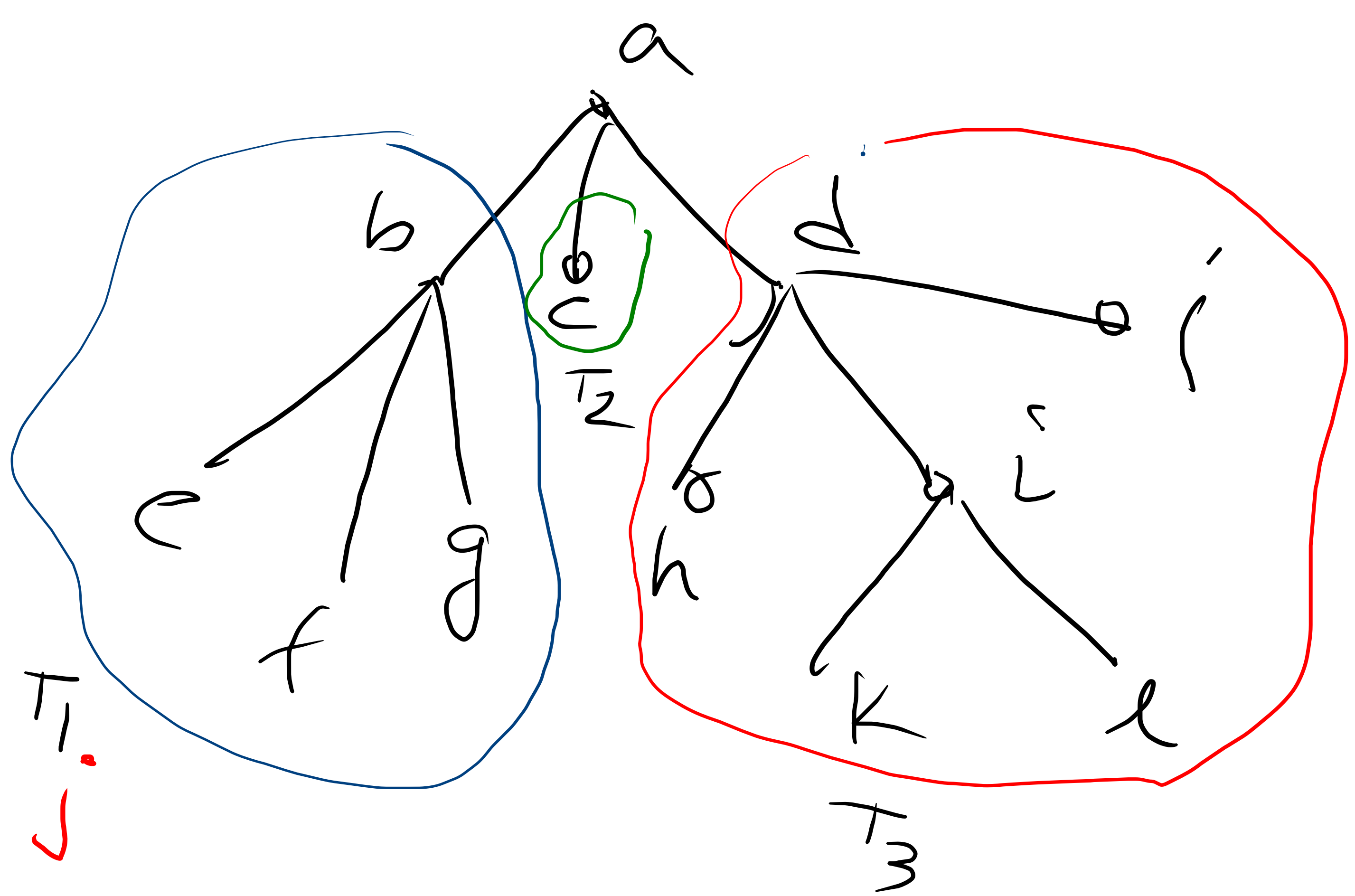
2. Inorder

3. Postorder.

Pre order traversal:



$r \quad T_1 \quad T_2 \quad \cdots \quad T_n$



$a \quad T_1 \quad T_2 \quad T_3$

a b e f g c d h i k l j