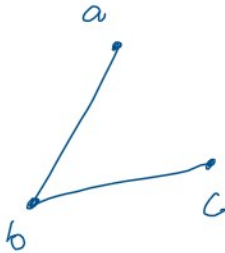


# Tree Graph

Tree  $\rightarrow$  A tree is a connected undirected graph with no simple circuits.

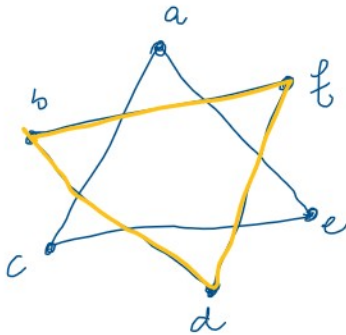
or a graph which is connected and cycle free is called a tree graph.  
 path b/w every pairs of vertices  
 No circuit or cycle

eg ①

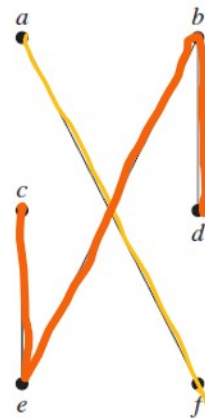
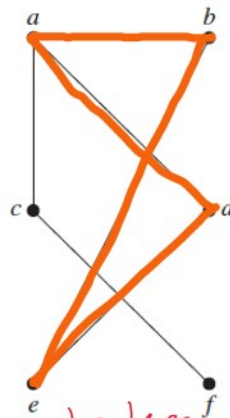
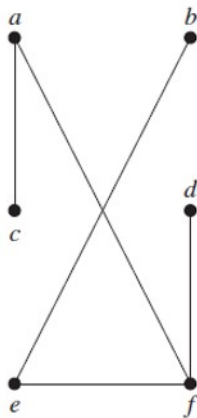
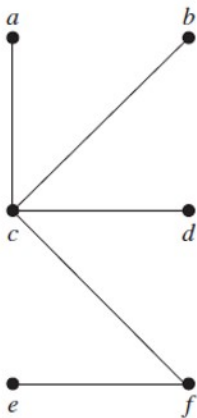


$\rightarrow$  Connected and cycle free  
 $\rightarrow$  Tree graph

②



Not connected & not even cycle free  
 Not a tree graph



$\rightarrow$  Forest

Not a tree

Not connected

Tree  
 ① Connected  
 ② cycle free

Tree  $G_2$   
 Connected cycle free also

Not a tree  $G_3$   
 Connected but not cycle free

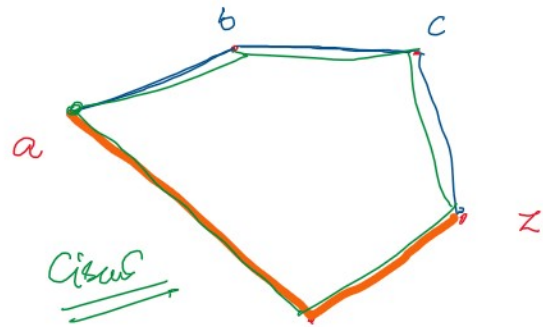
$G_4$

- (1) Connected  
(2) cycle free

conn  
cycle free  
also

conn-  
not cycle  
free

# An undirected graph is a tree if and only if there is a unique simple path between any two of its vertices

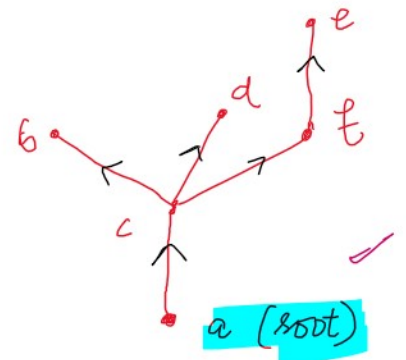
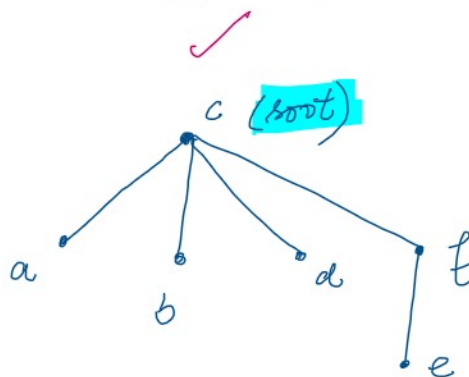
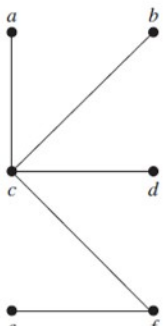


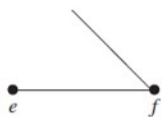
# Forest  $\rightarrow$  is a graph with the property that each of its connected components is a tree (with no simple circuits)

$\rightarrow$  A graph not necessarily connected but with no simple circuit is called a forest.

# Rooted tree  $\rightarrow$

A rooted tree is a tree in which one vertex has been designated as the root and every edge is directed away from that root.

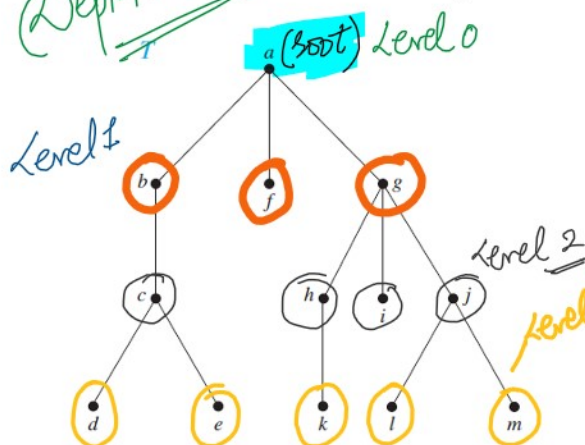




• a (root)

Every tree is a rooted tree (by choosing any vertex as the root).

Depth = 3



① parent  $\Rightarrow$  The parent of vertex  $v$  (other than root) is the unique vertex  $u$  such that there is a directed edge from  $u$  to  $v$ .

e.g.  $a$  is the parent of  $b, f$  and  $g$ .

② child  $\Rightarrow$  When  $u$  is the parent of  $v$  then  $v$  is called child of  $u$ .

e.g. The children of  $g$  are  $h, i$  and  $j$ .

③ sibling  $\Rightarrow$  vertices with the same parents.

e.g.  $b, f$  and  $g$  are siblings.

④ ancestors  $\Rightarrow$

The ancestors of a vertex (other than root) are the vertices in the path from root to this vertex (except the vertex itself).

e.g. The ancestors of  $m$  are  $j, g$  and  $a$ .

⑤ Descendants  $\Rightarrow$

The descendants of a vertex  $u$  are those vertices that have  $u$  as an ancestor.

e.g. The descendants of  $b$  are  $c, d$  and  $e$ .

⑥ Leaf  $\Rightarrow$  vertices with no children.

⑦ Internal vertices  $\Rightarrow$  vertices with children.

⑧ Level of a vertex  $\Rightarrow$  The length of the path from root to the vertex.

1

- 1 root.

⑧

area of ..

~ ~

veien.

⑨

Depth / Height of the tree

Maximum Level of the veien in the graph