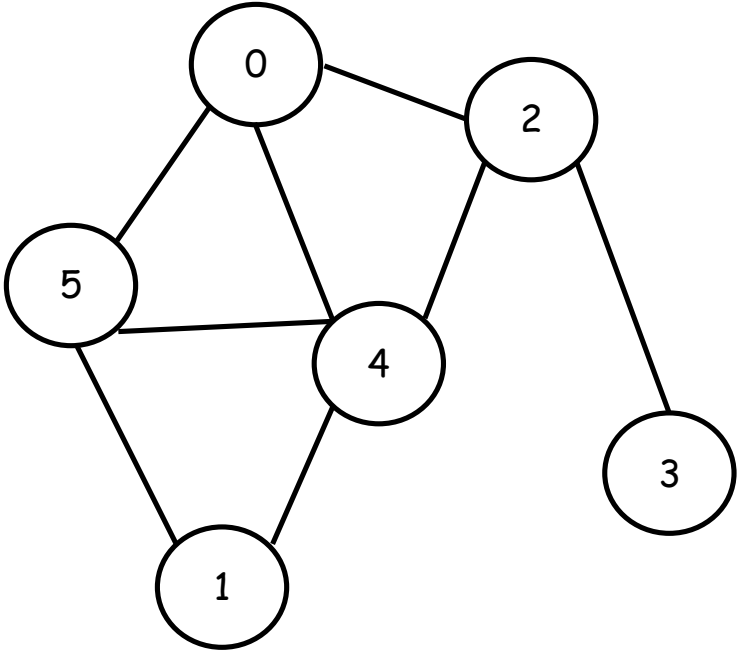
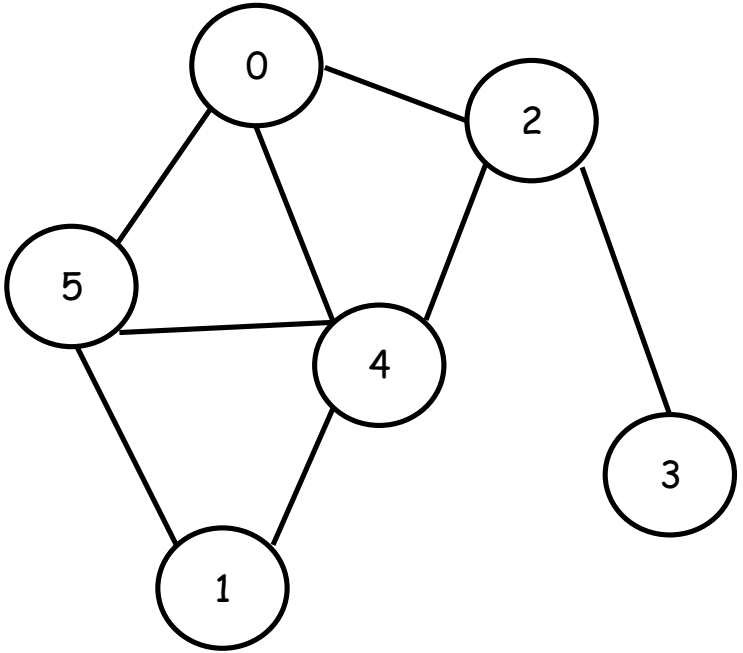
Trees

Introduction to Trees

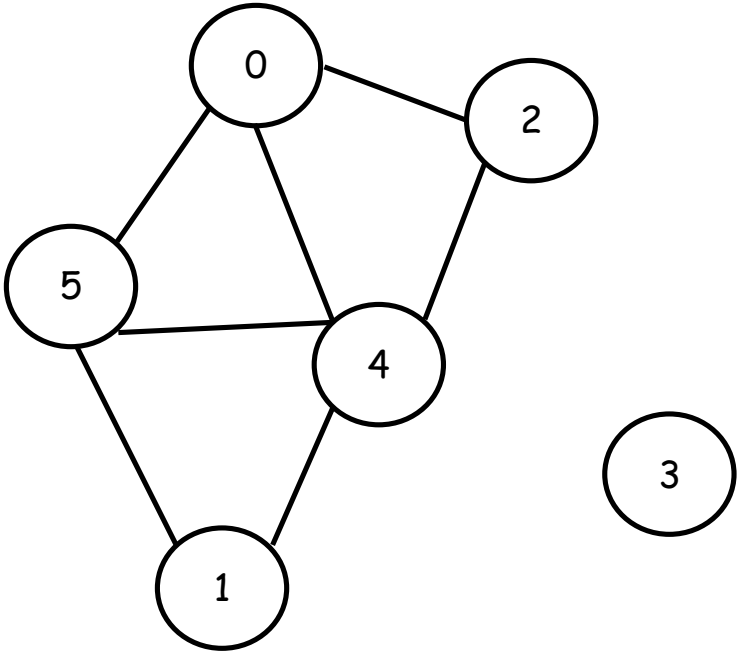
a connected undirected graph with no simple circuits

Connected Graph





Connected Graph

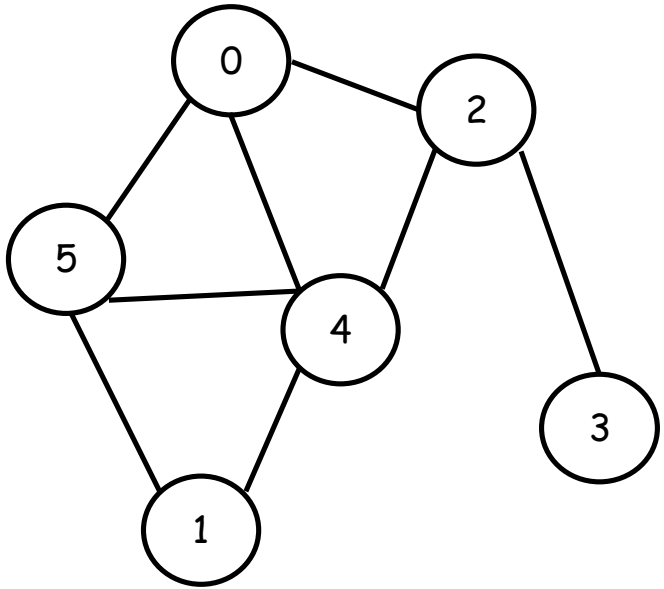


Not a tree

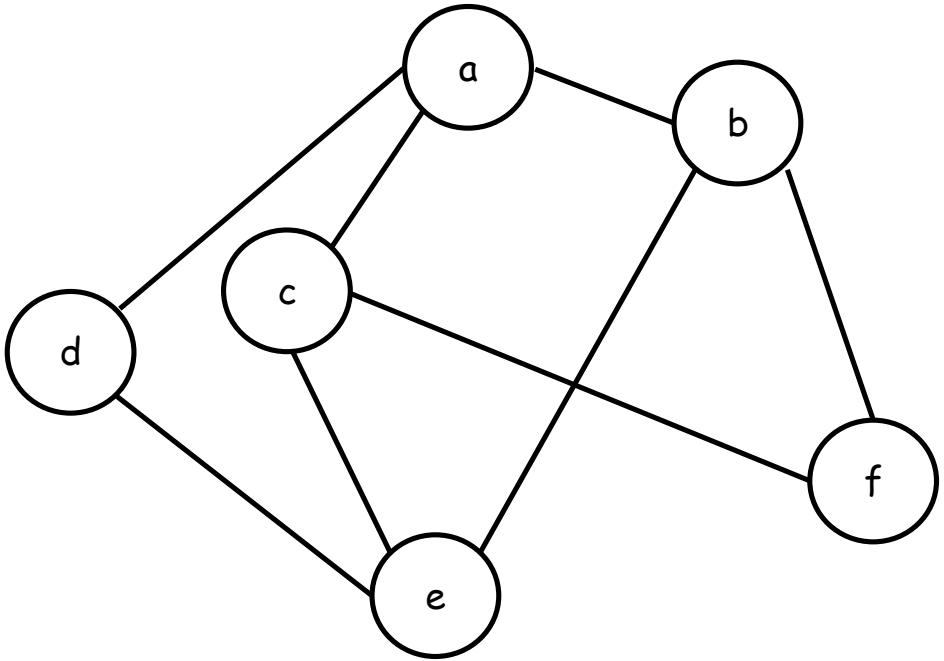
Simple Circuits

Simple path that begins and ends at the same vertex.

Simple path: a sequence of vertices without
repetition

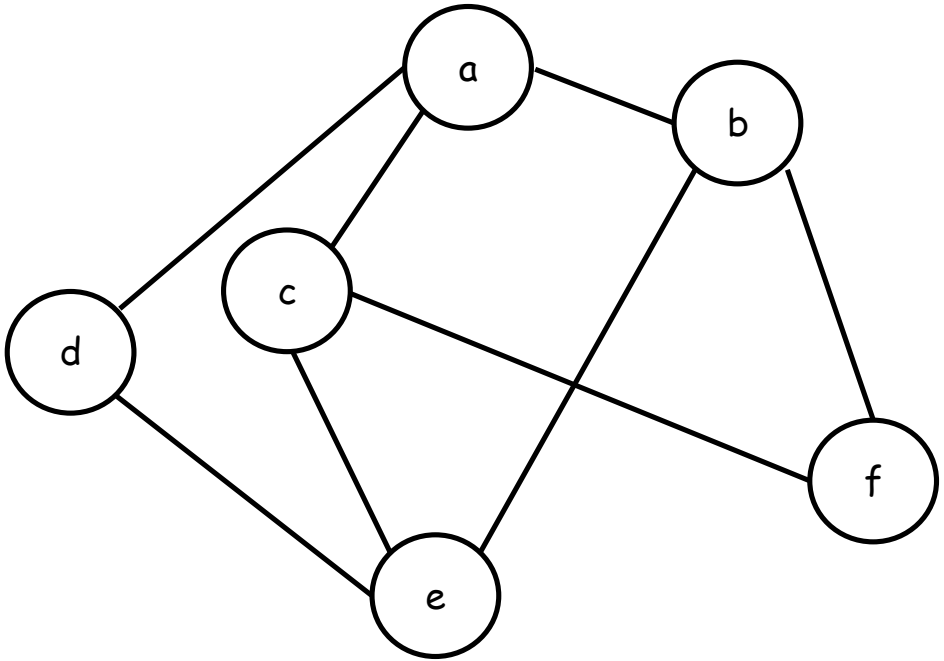


Simple Circuit



Not a tree

Simple Circuit

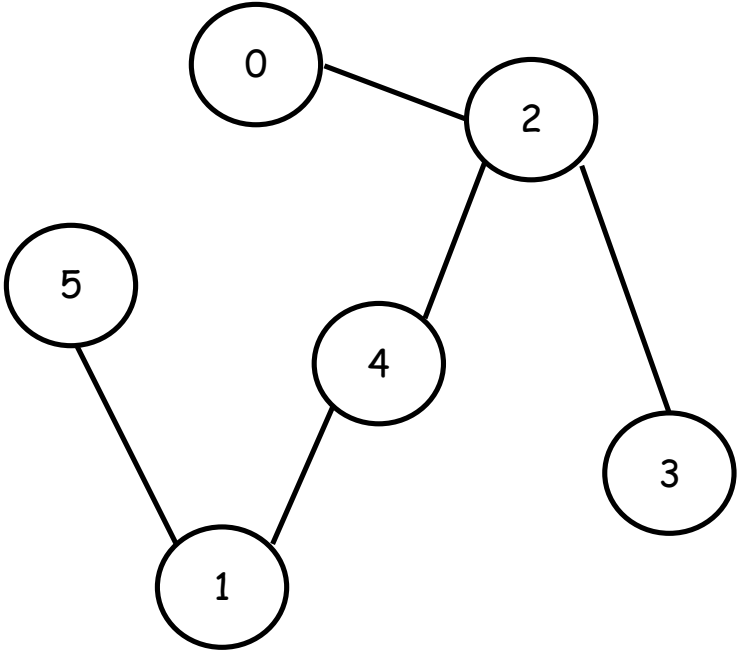


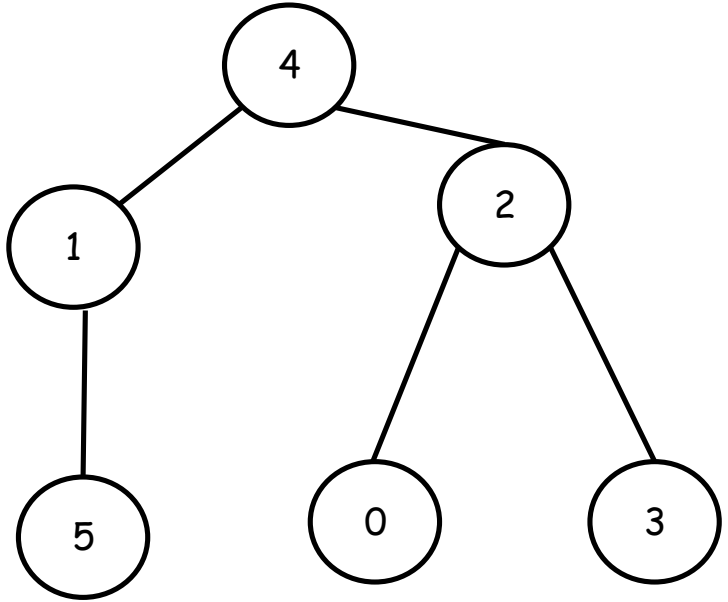
Not a tree

Rooted Tree

one vertex is designated as the root and every edge is directed away from the root.

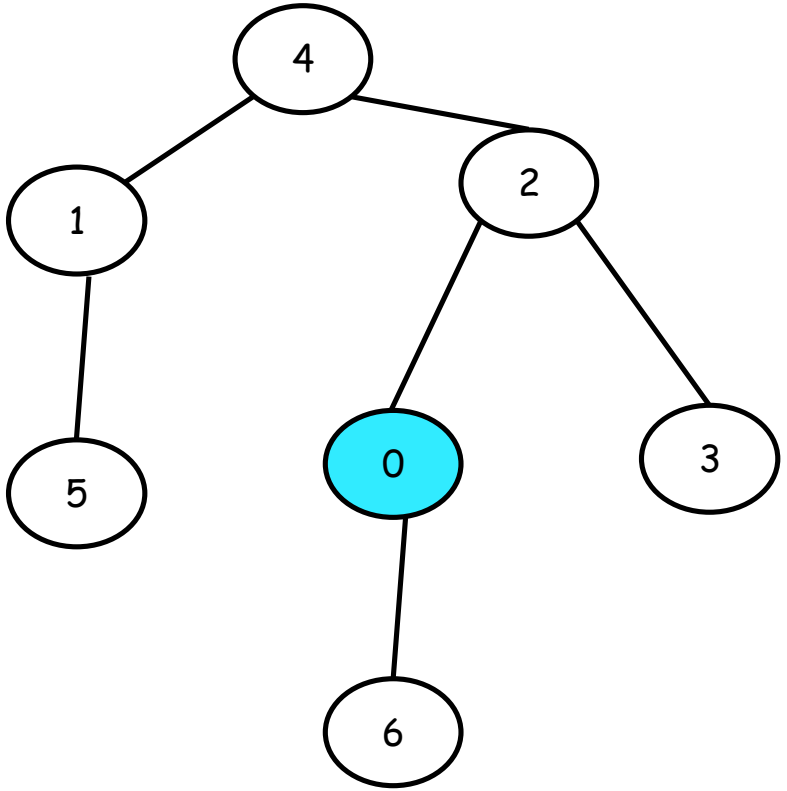
Rooted Tree





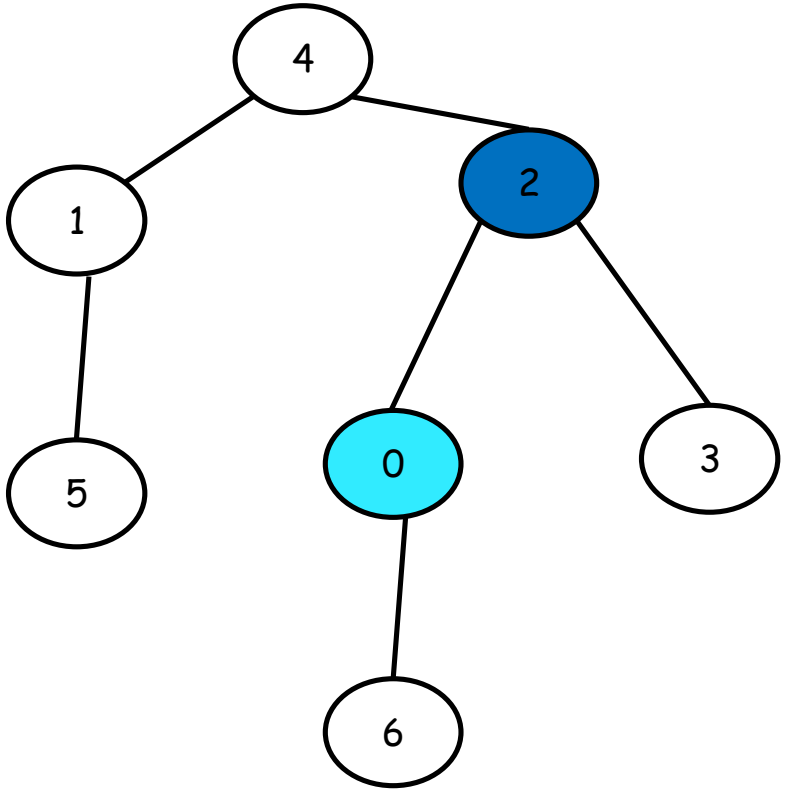
Parent

Parent of 0 =



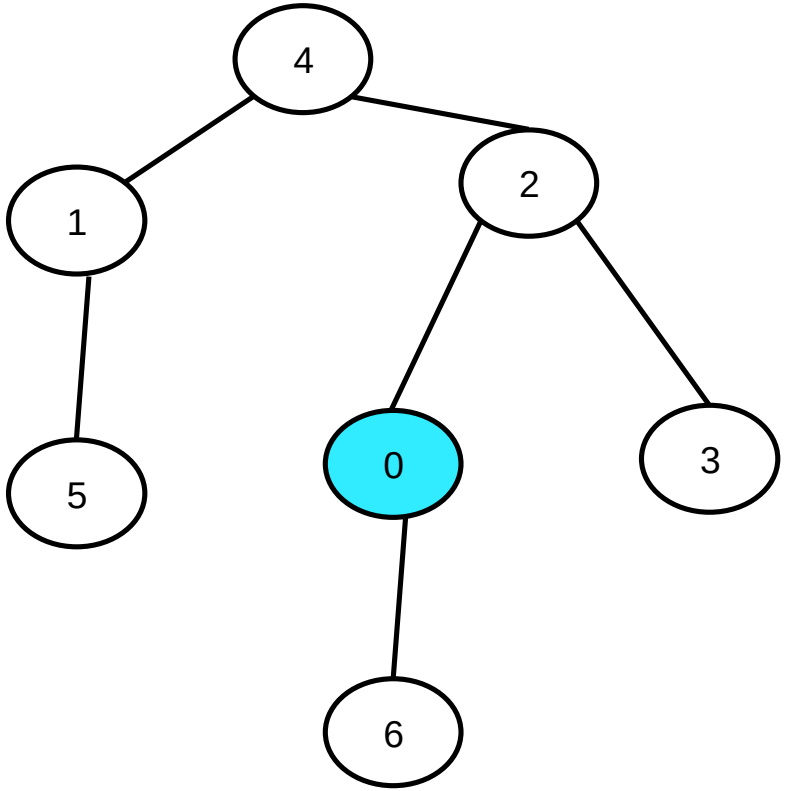
Parent

Parent of 0 = 2



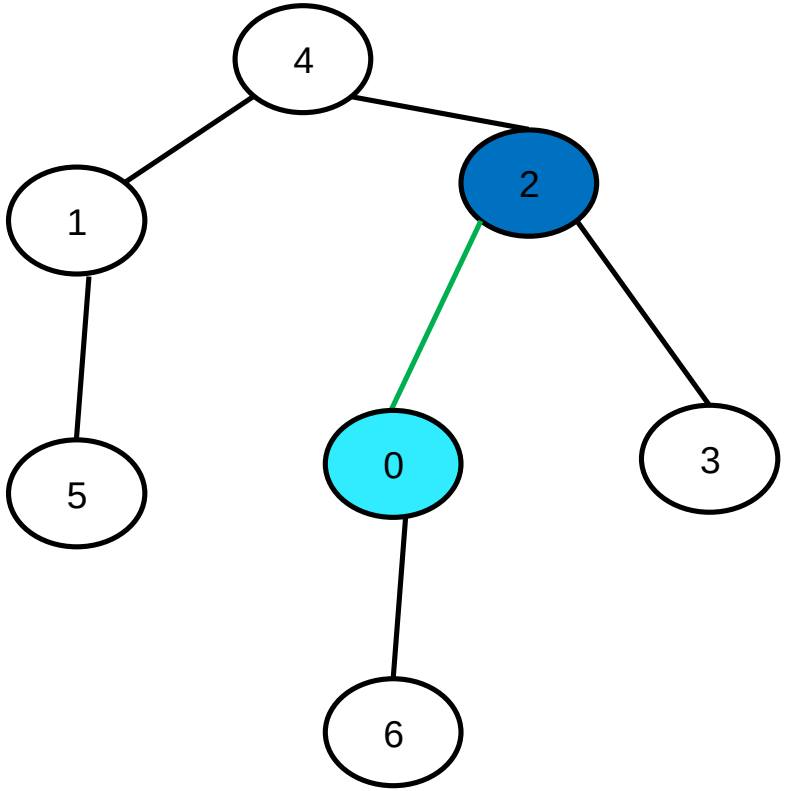
Siblings

Siblings of 0 =



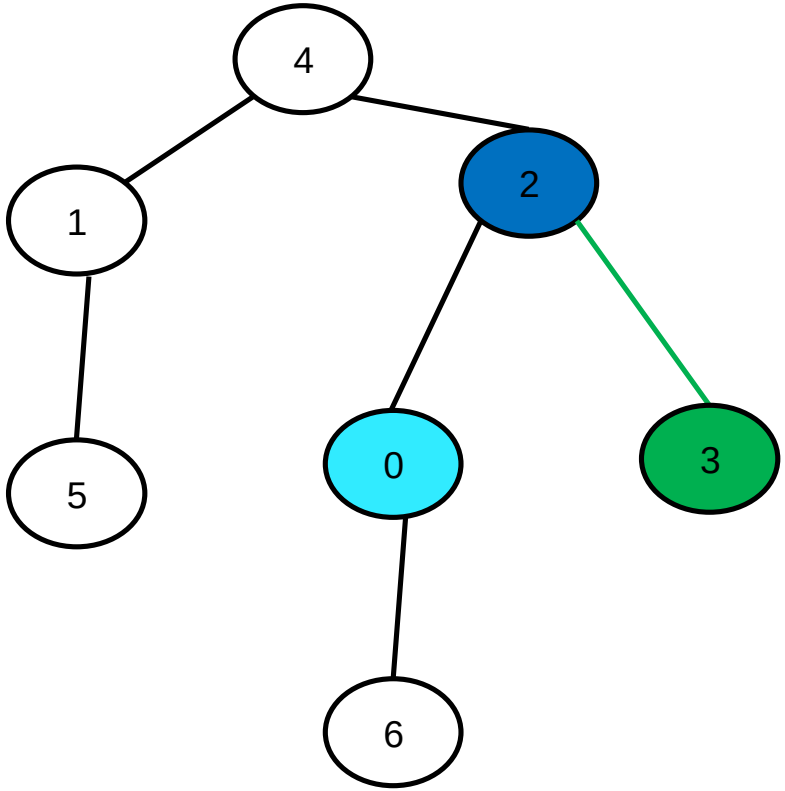
Siblings

Siblings of 0 =



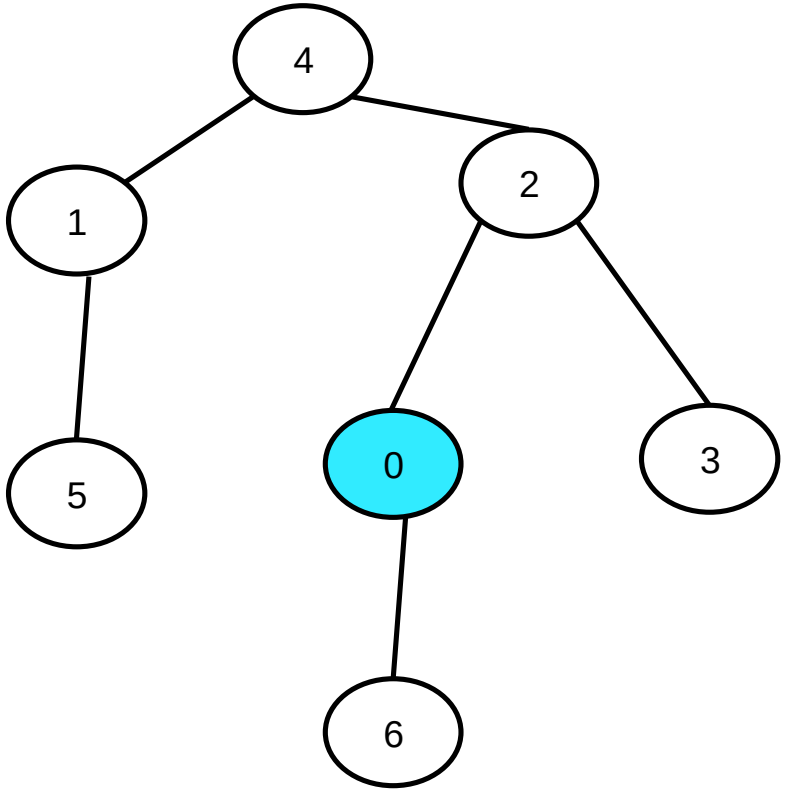
Siblings

Siblings of 0 = 3



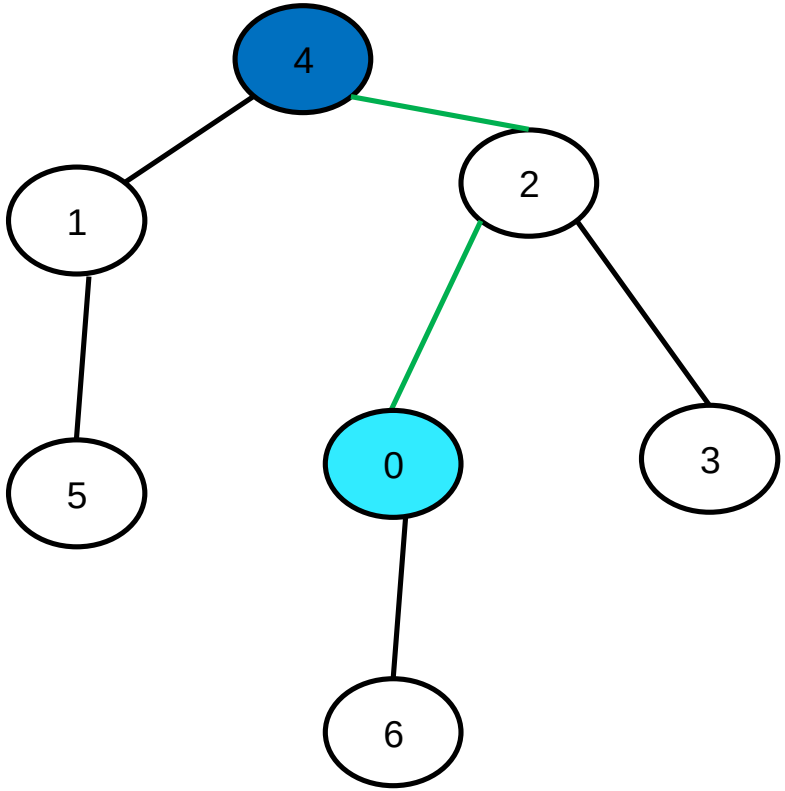
Ancestor of a vertex

Ancestor of 0 =
vertices in the path from root ⇨ vertex 0
Excluding 0



Ancestor of a vertex

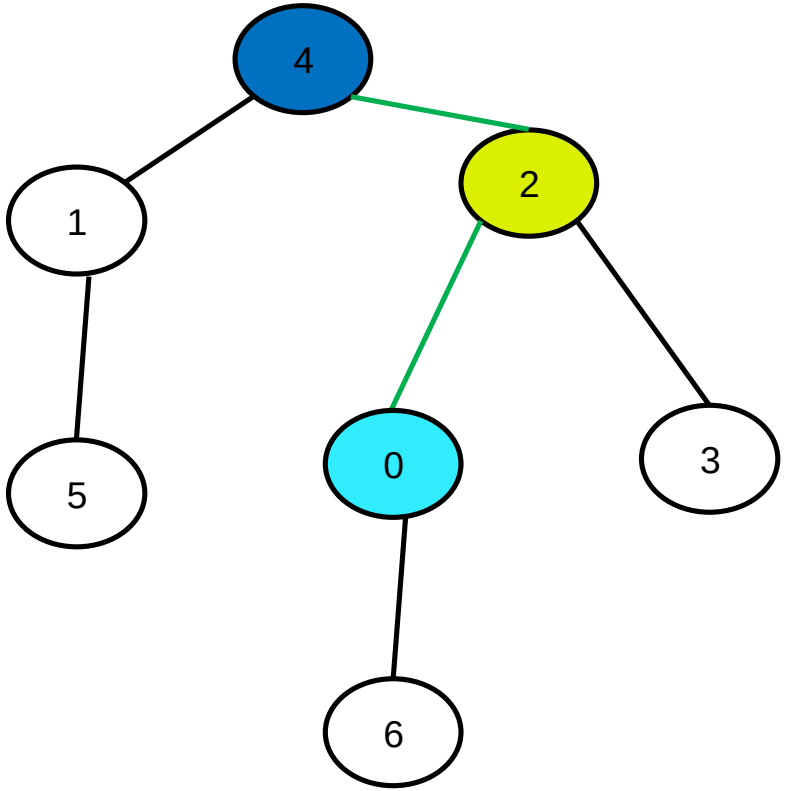
Ancestor of 0 = vertices in the path from root ⇨ vertex 0 Excluding 0



Ancestor of a vertex

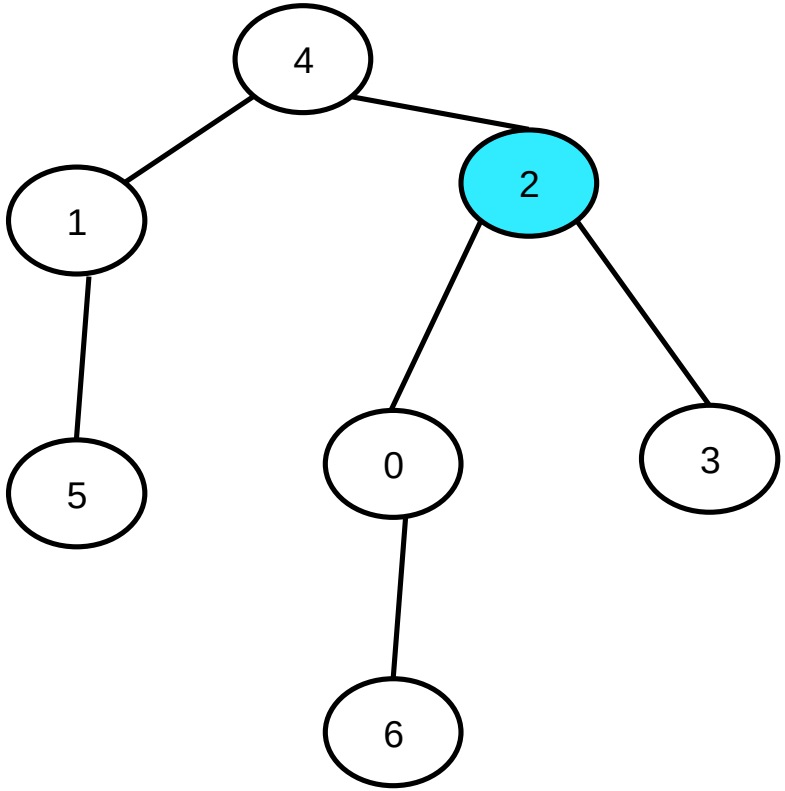
Ancestor of 0 = vertices in the path from root → vertex 0 Excluding 0

4 , 2



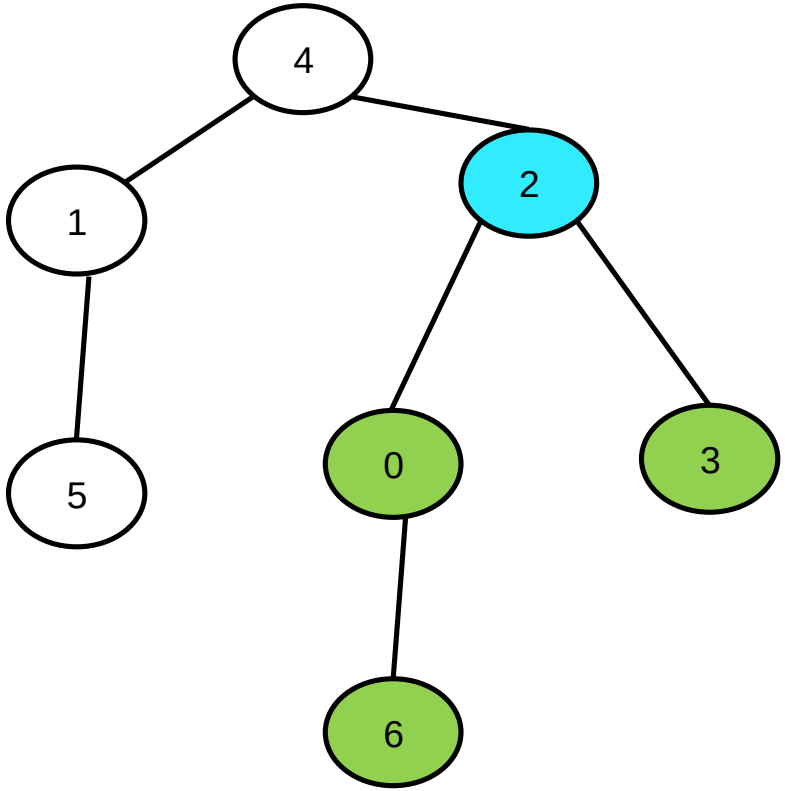
Descendant of a vertex

Descendants of 2 = vertices whose ancestors are 2



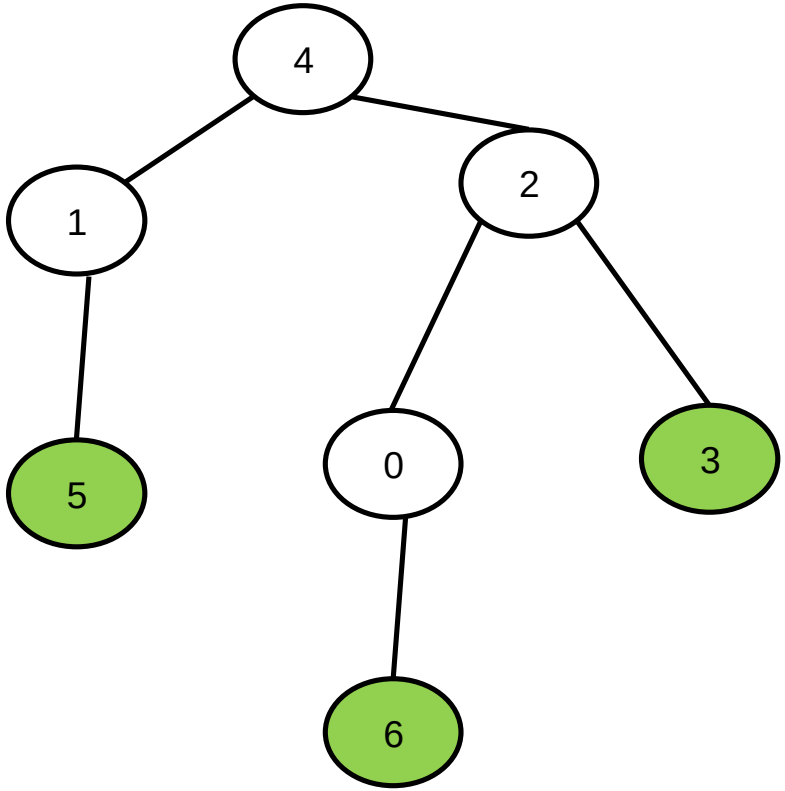
Descendant of a vertex

Descendants of 2 = 0, 3, 6



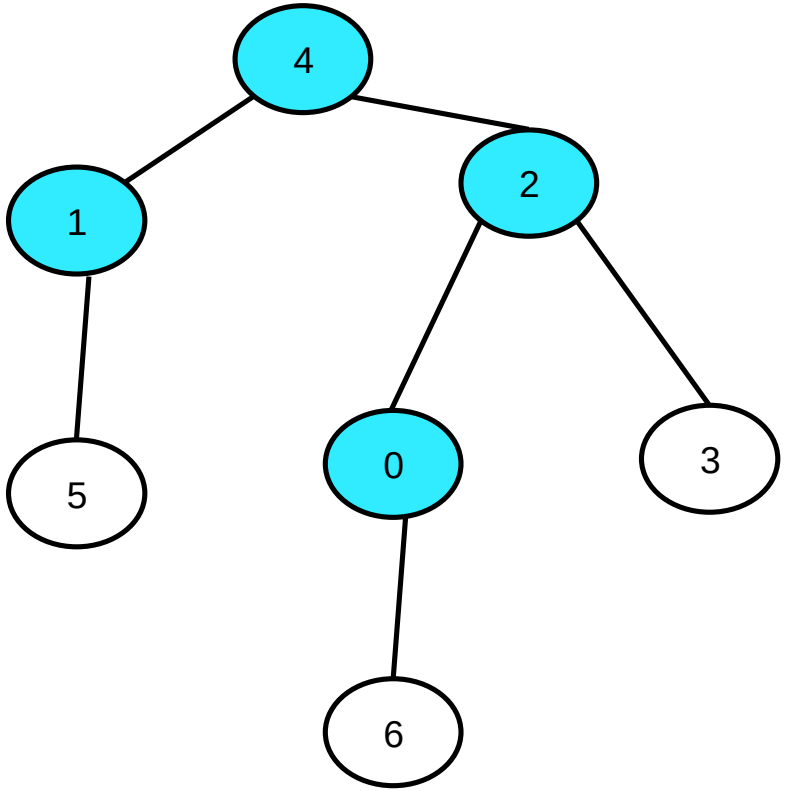
Leaf Nodes

Vertices that have no children

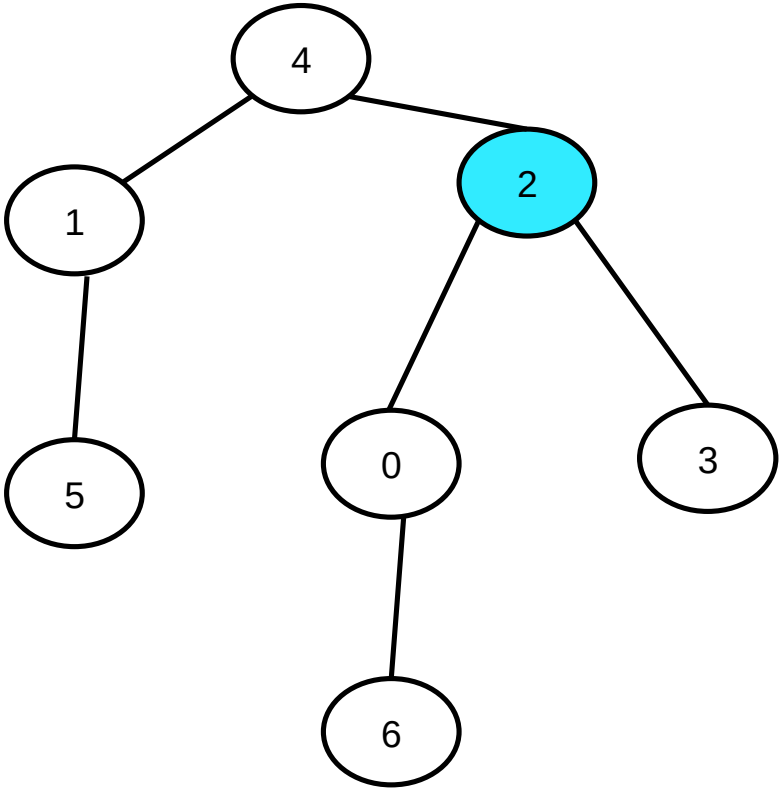


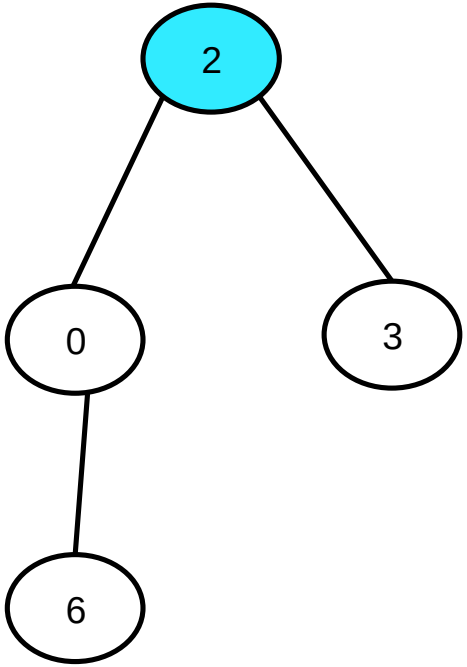
Internal Nodes

Vertices that have children



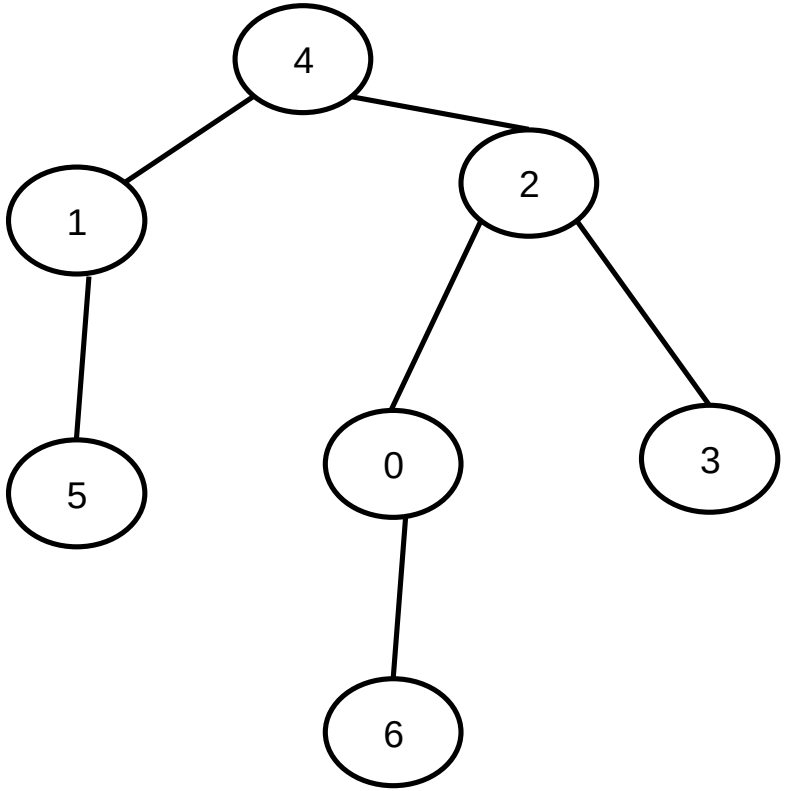
Subtree rooted at a vertex





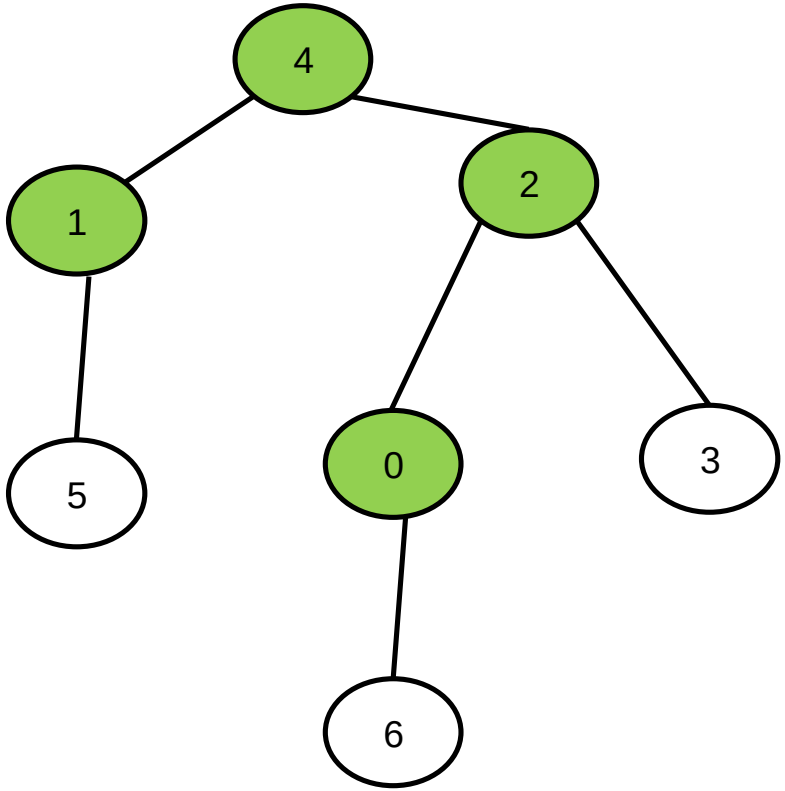
M-ary tree

No of children of **every** internal vertex **<=** m



M-ary tree

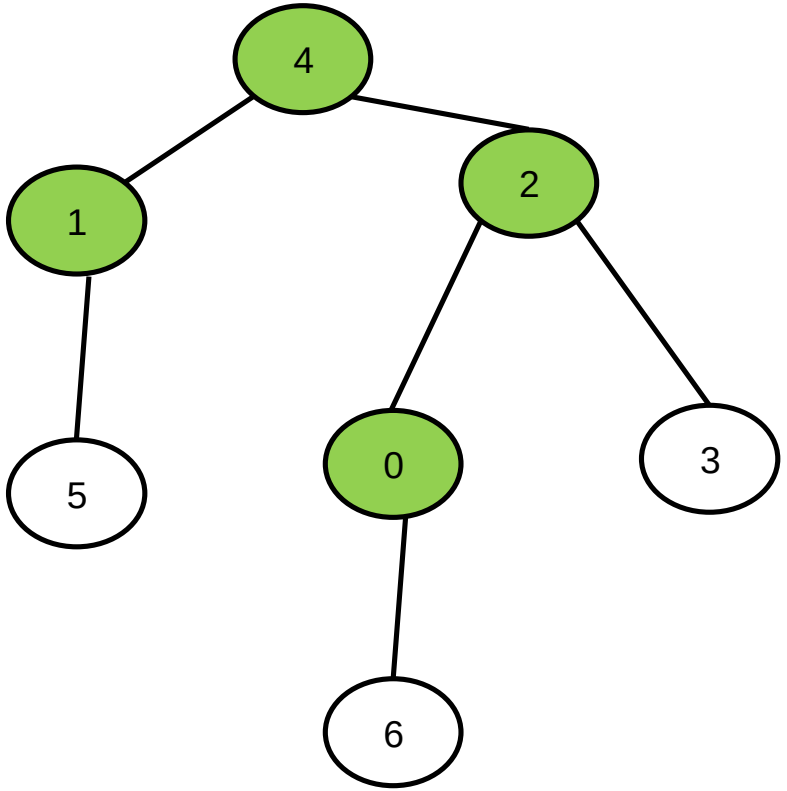
No of children of **every** internal vertex <= m



M-ary tree

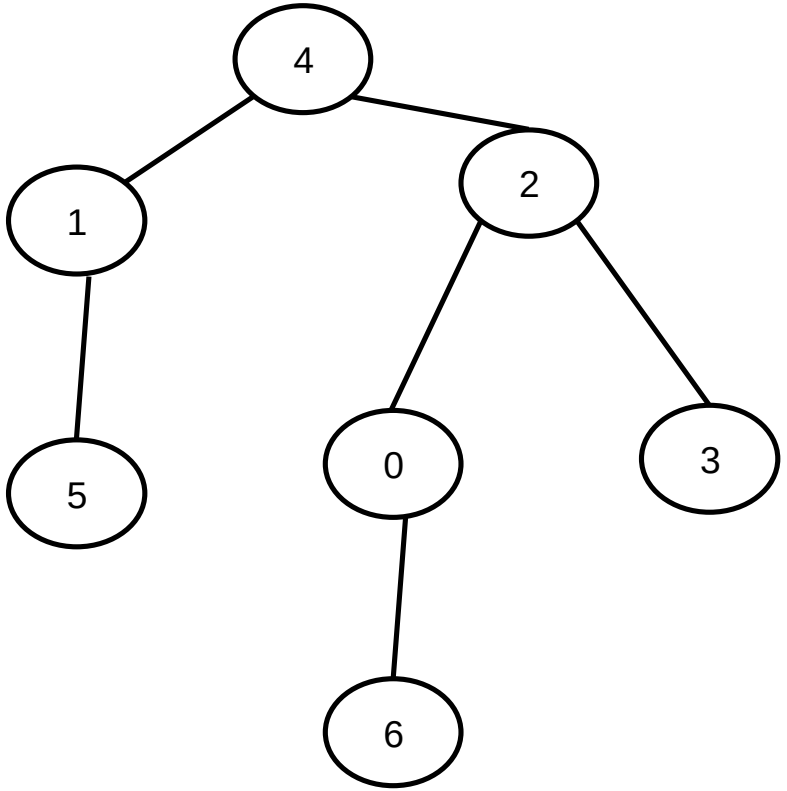
Vertex 4 = 2
Vertex 1 = 1
Vertex 2 = 2
Vertex 0 = 1

A 1- ary tree	No
A 2- ary tree	Yes
A 3- ary tree	Yes



Full M-ary tree

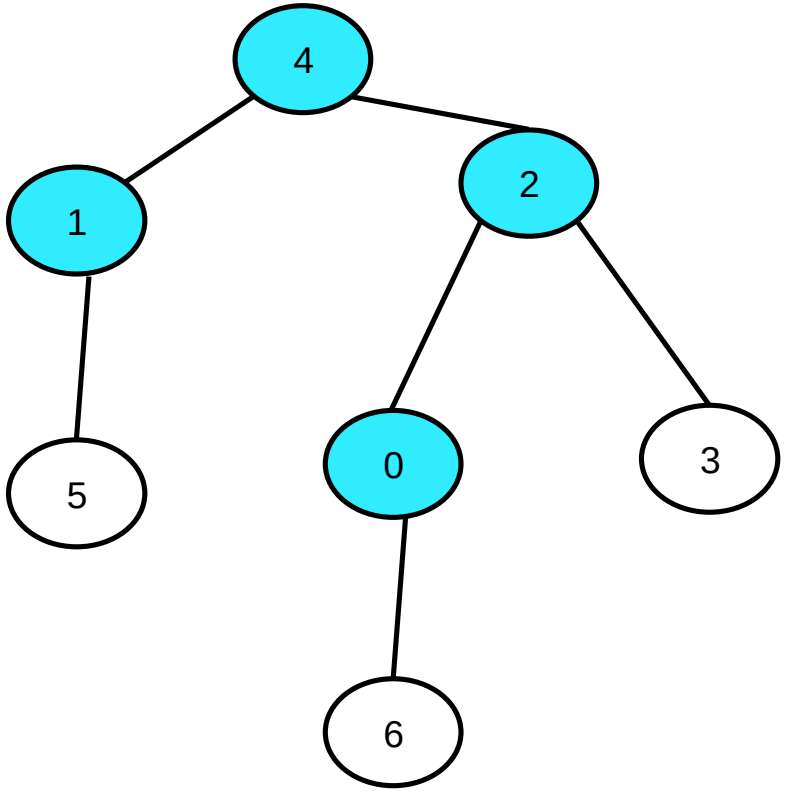
No of children of **every** internal vertex = m



M-ary tree

Vertex 4 = 2
Vertex 1 = 1
Vertex 2 = 2
Vertex 0 = 1

A Full 1- ary tree No
A Full 2- ary tree No

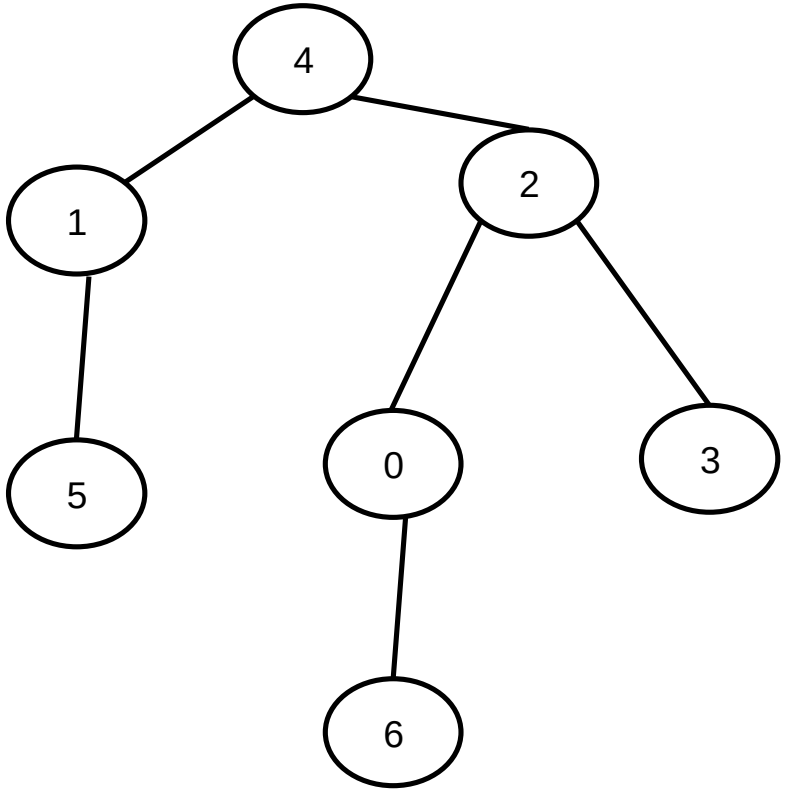


Ordered Rooted Tree

the children of each internal vertex are shown in ordered from left to right.

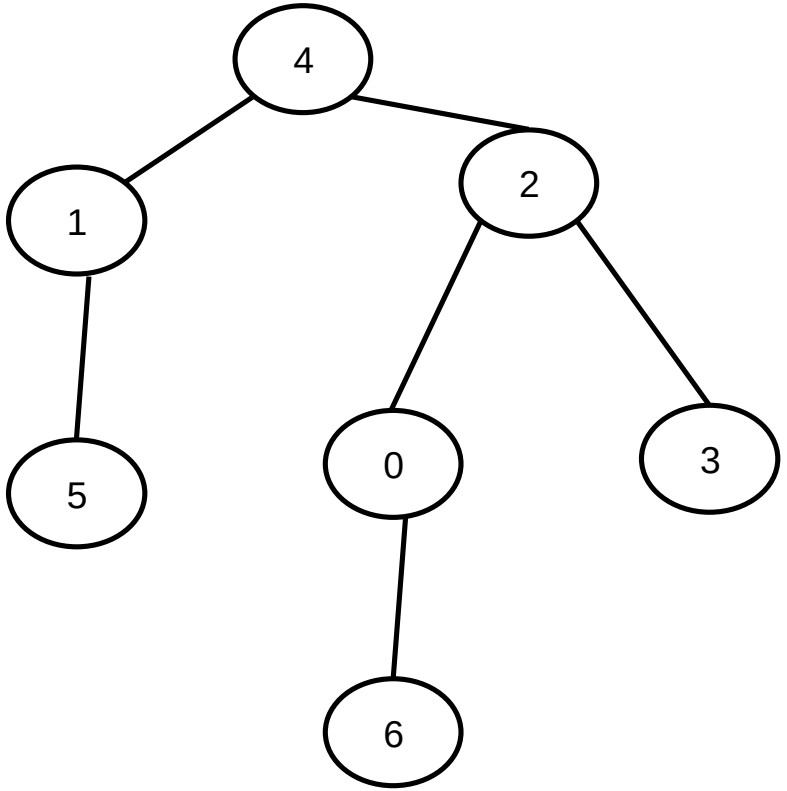
First child of 2 = 0 (Left child)

Second child of 2 = 3 (Right child)



Level of a vertex

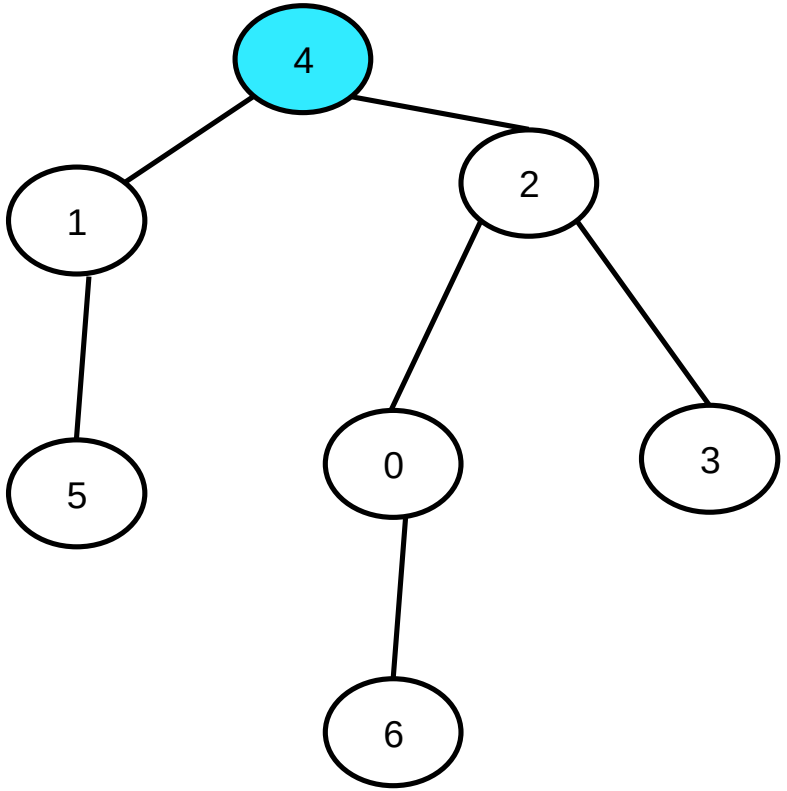
the length of the unique path from the root to this vertex.



Level of a vertex

the length of the unique path from the root to this vertex.

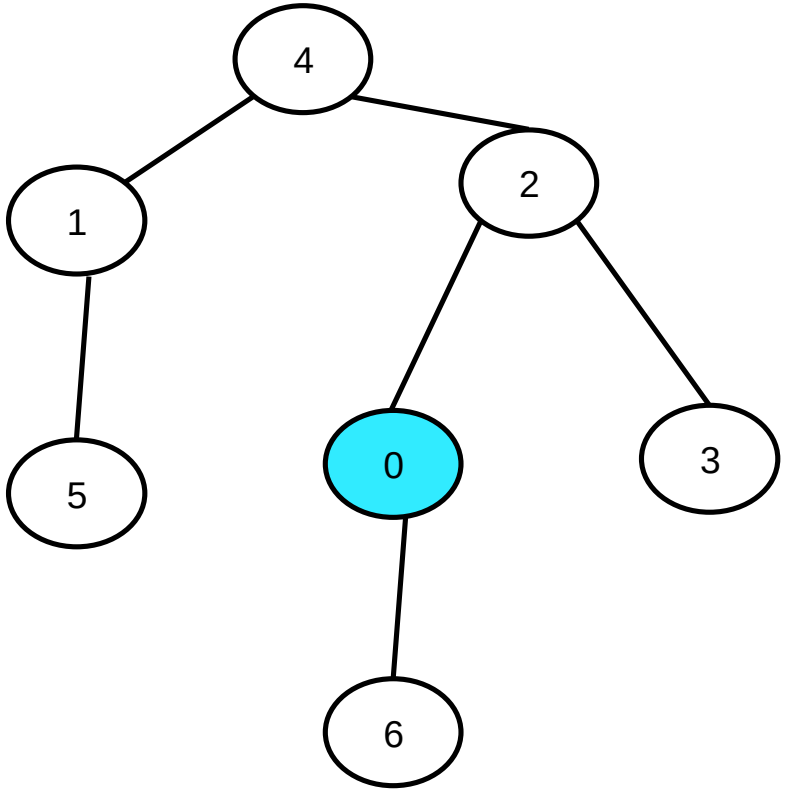
LEVEL OF ROOT = 0



Level of a vertex

the length of the unique path from the root to this vertex.

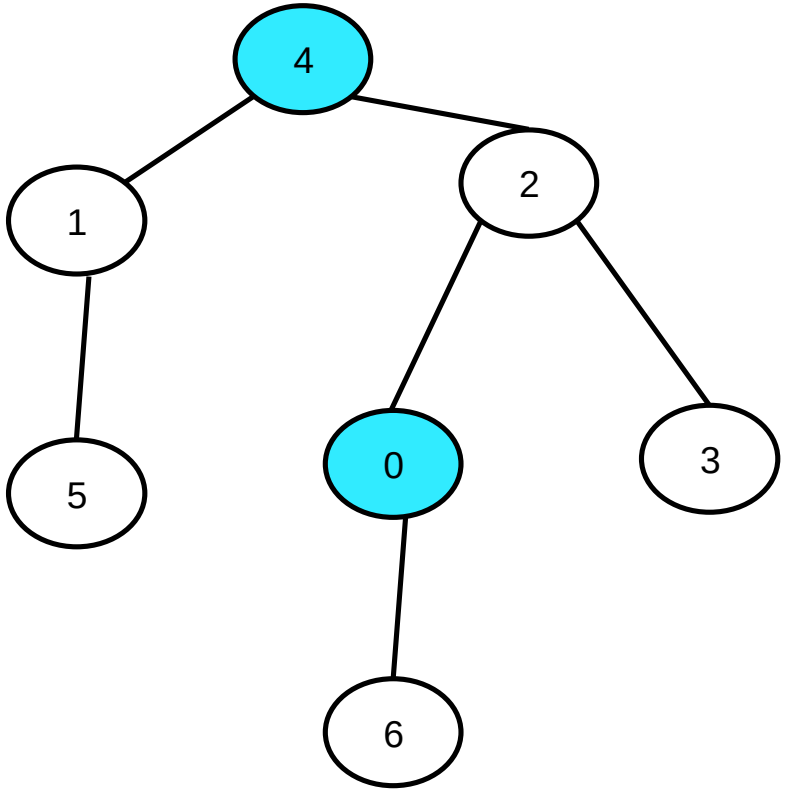
LEVEL OF 0 =



Level of a vertex

the length of the unique path from the root to this vertex.

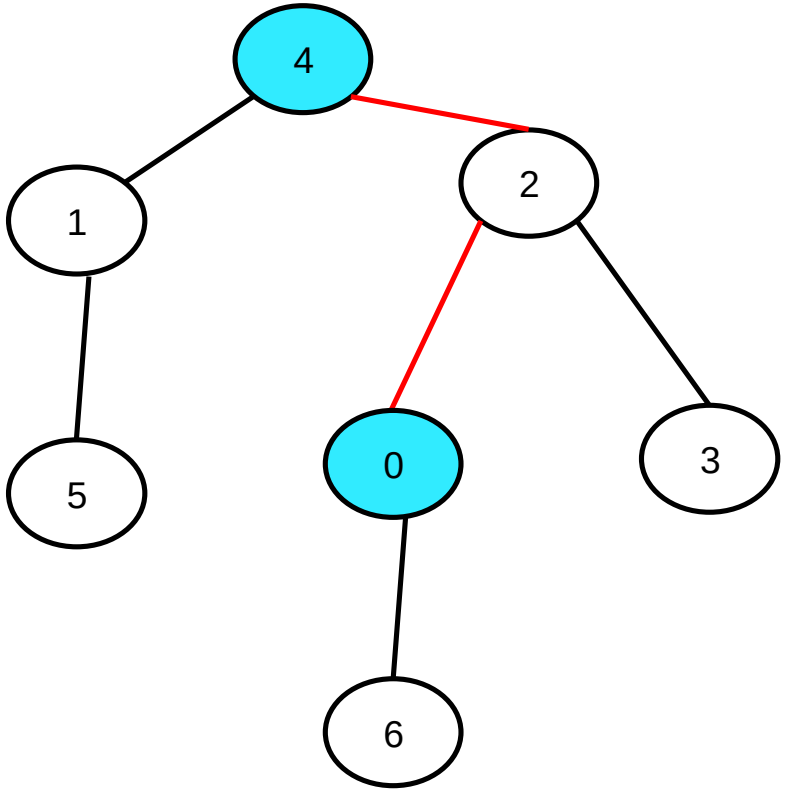
LEVEL OF 0 =



Level of a vertex

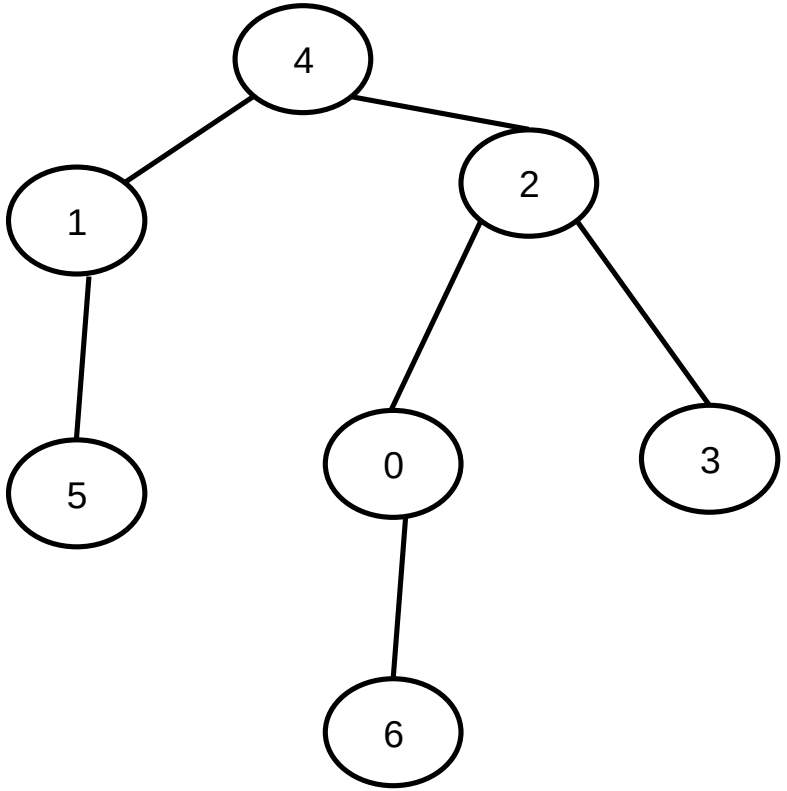
the length of the unique path from the root to this vertex.

LEVEL OF 0 = 2



Height of a tree

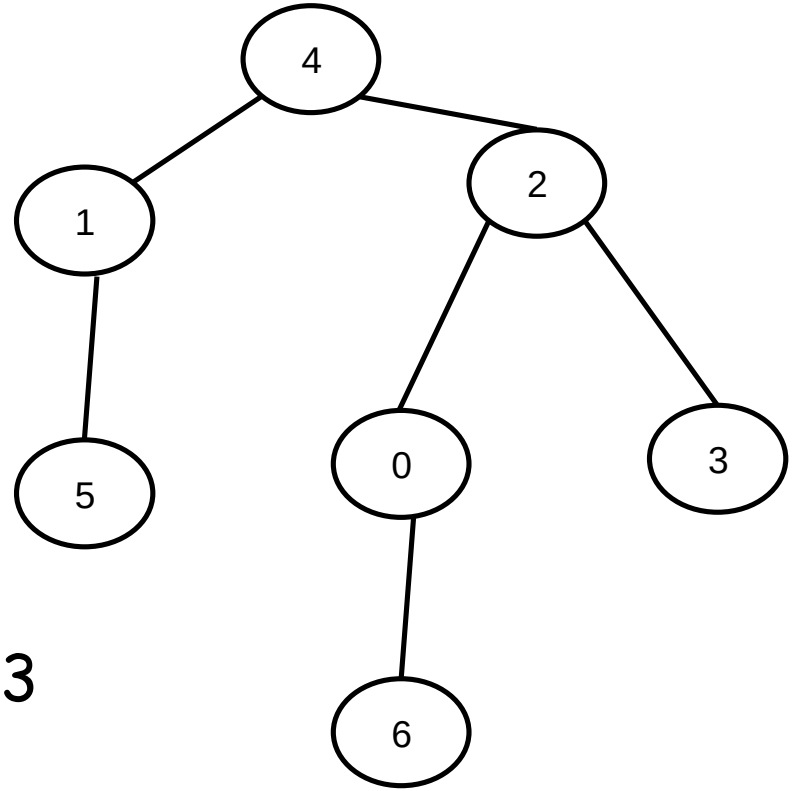
= MAX (Level of vertices)



Height of a tree

= MAX (Level of vertices)

Level of
Vertex 4 = 0
Vertex 1 = 1
Vertex 2 = 1
Vertex 5 = 2
Vertex 0 = 2
Vertex 3 = 2
Vertex 6 = 3



Height = Max(0, 1 , 1, 2, 2, 3) = 3

Balanced Tree

If height = h, all the leaves are at Level **h** or **h-1**

Level of

Vertex 4 = 0
Vertex 1 = 1
Vertex 2 = 1
Vertex 5 = 2
Vertex 0 = 2
Vertex 3 = 2
Vertex 6 = 3

Height = 3