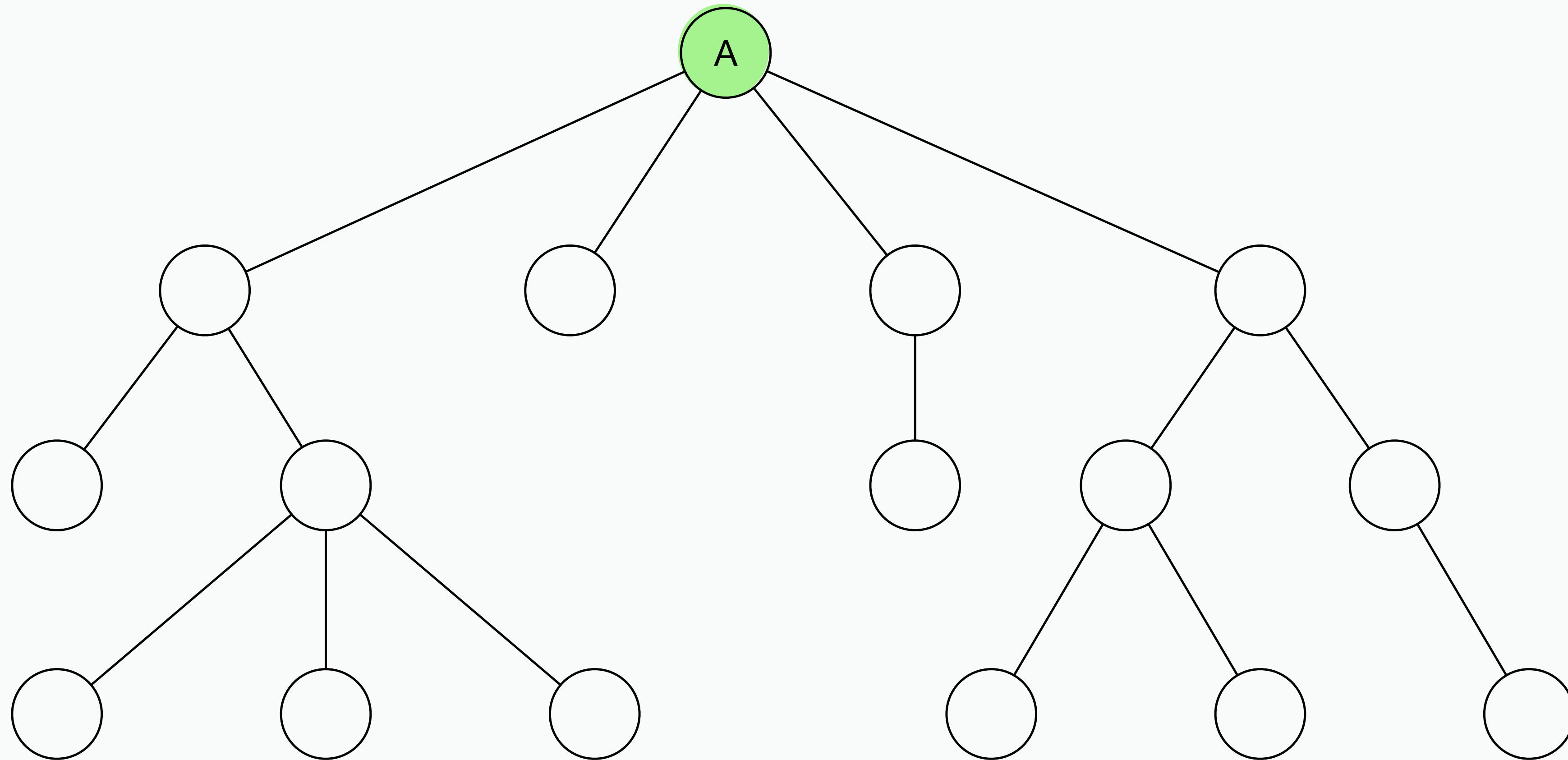


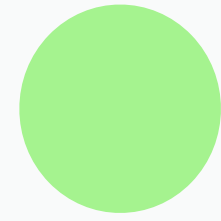
Rooted trees

One node may have special status. We call that the
has a root node we call it a

. If the tree

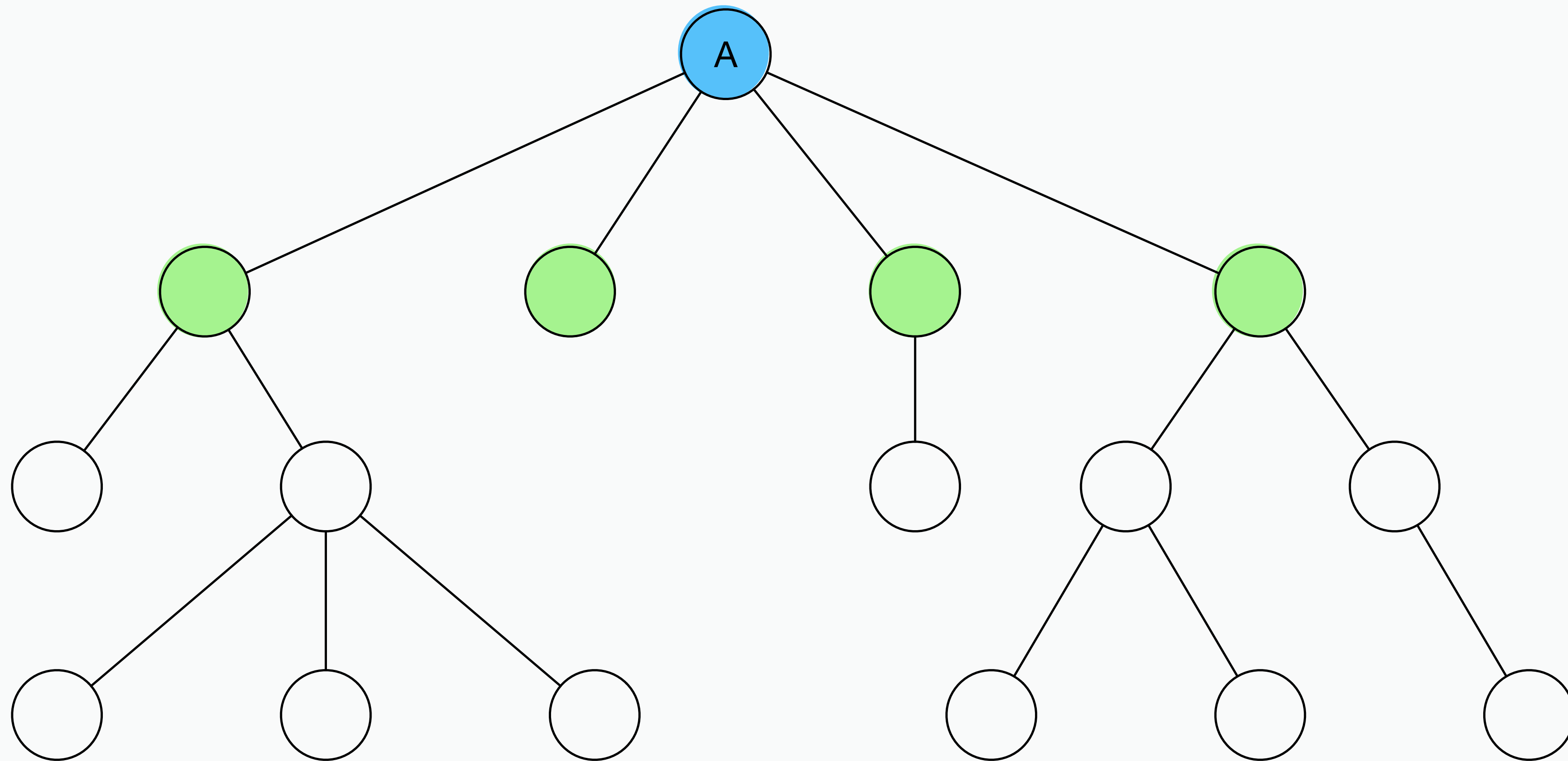


Rooted trees



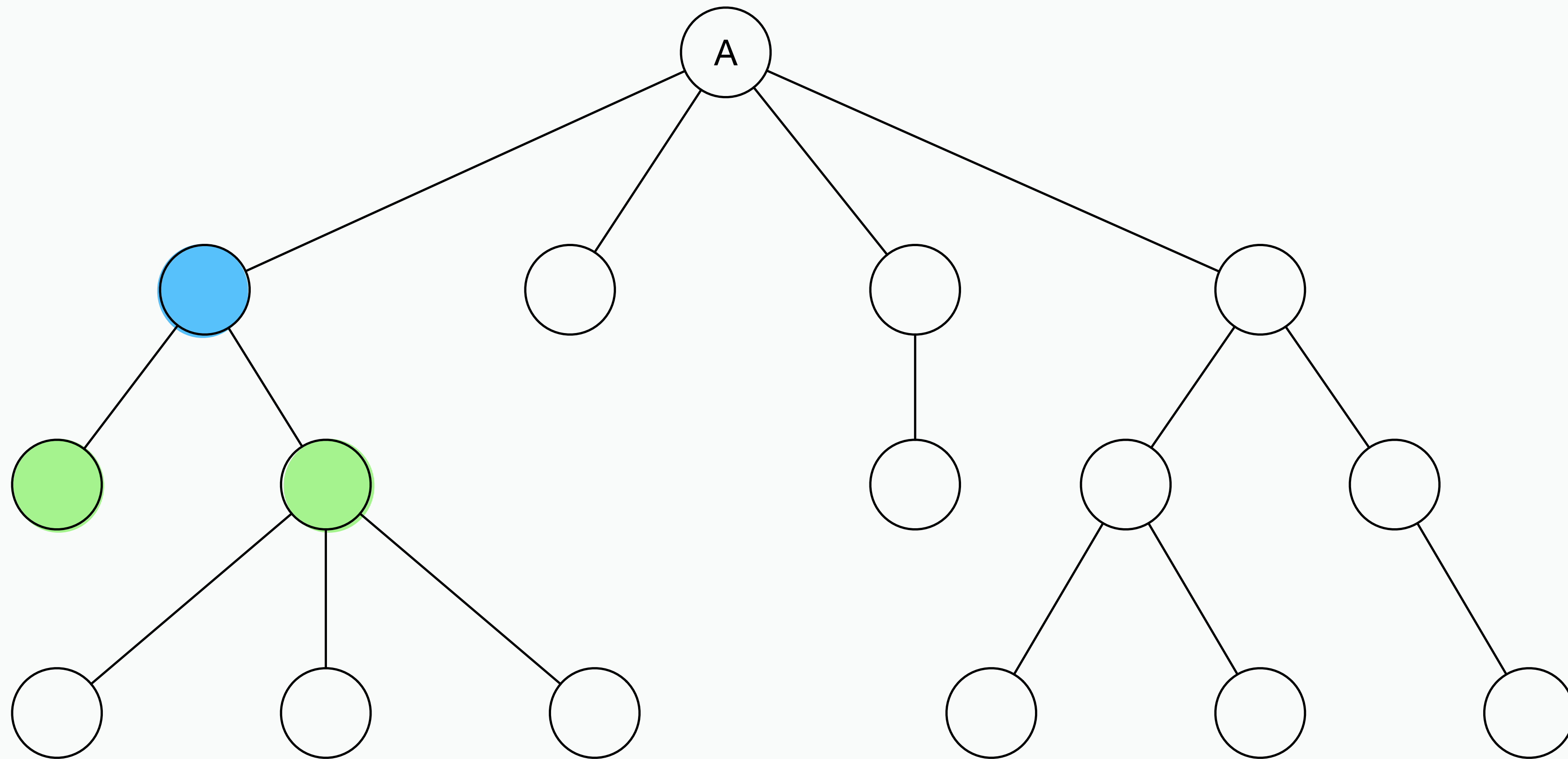
Rooted trees

A node may have more than one child, but each node (apart from the root) has only one parent.



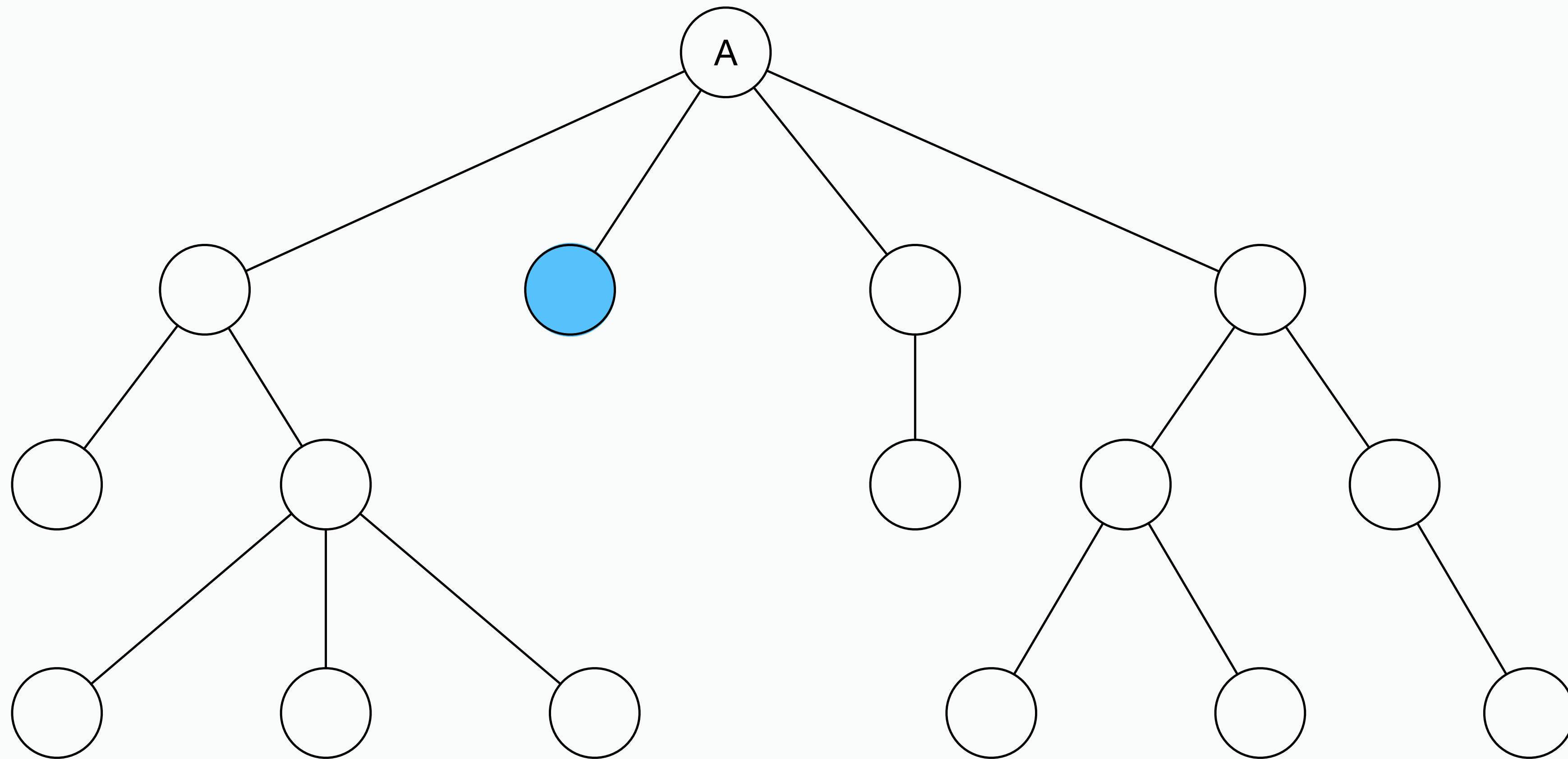
Rooted trees

B has two children, F and G.



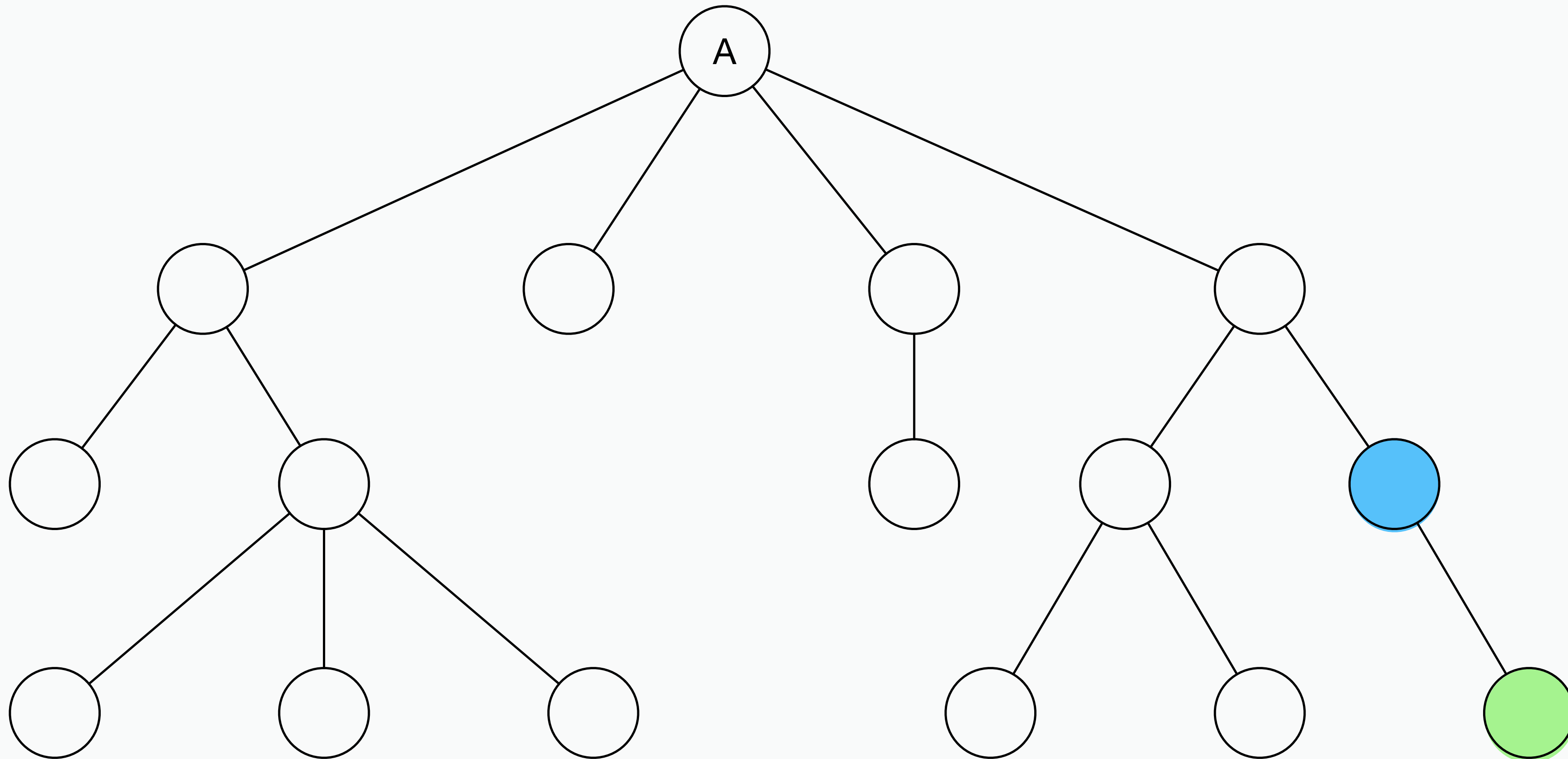
Rooted trees

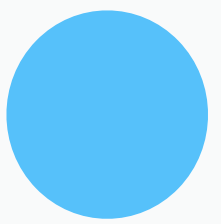
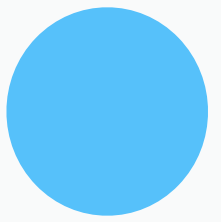
C has no children.



Rooted trees

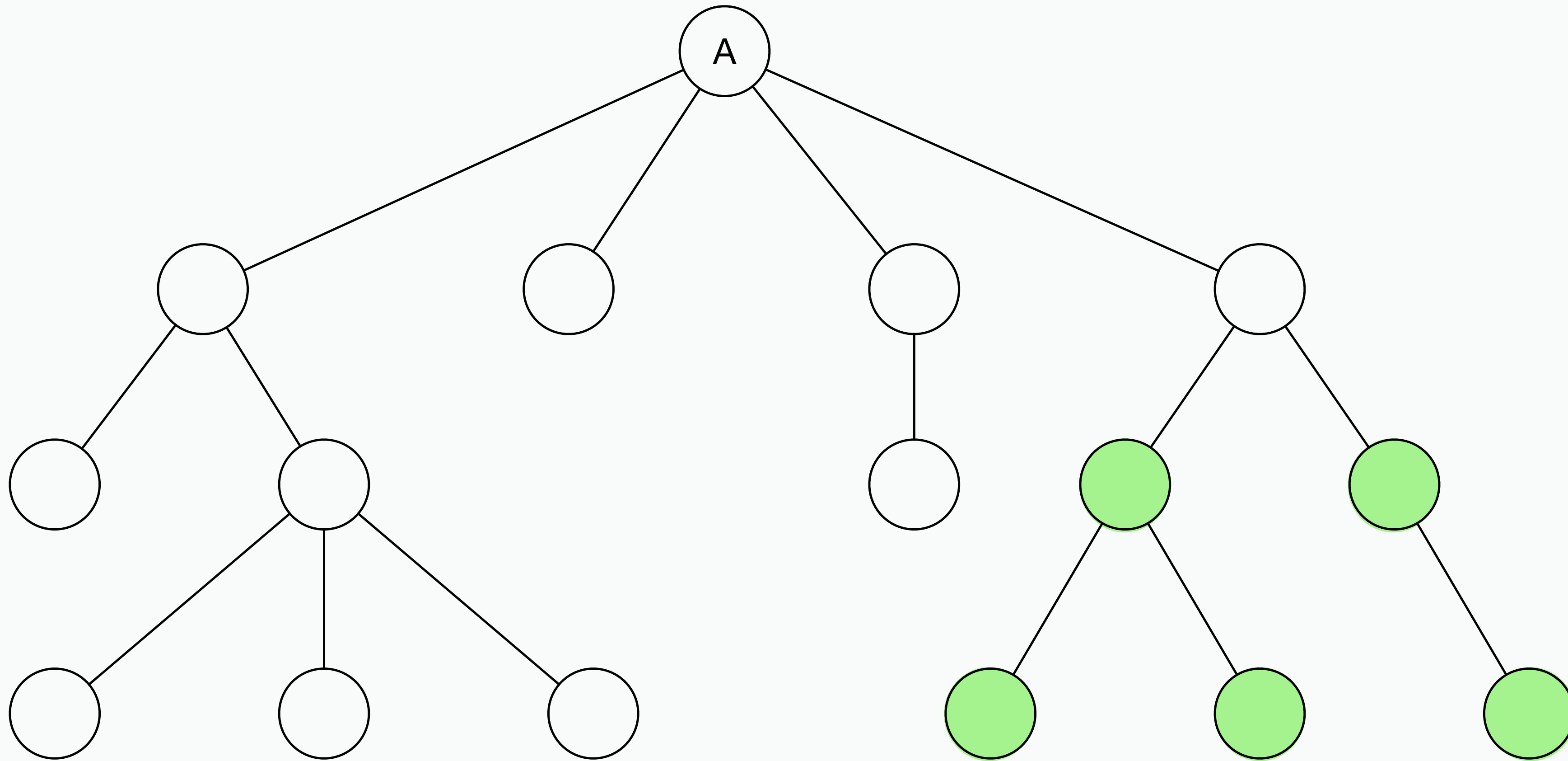
The parent of P is J.





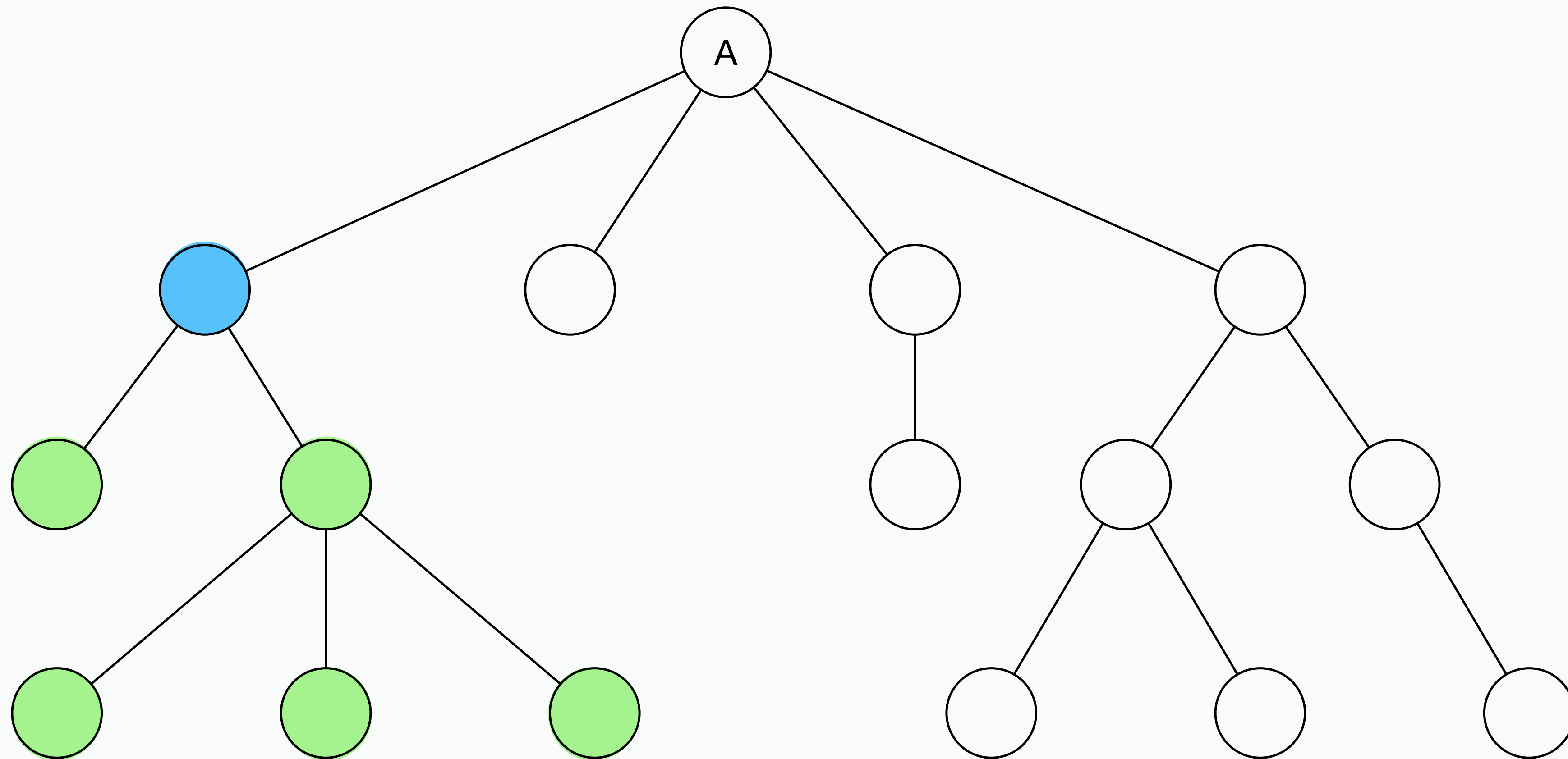
Rooted trees

These are the descendants of E.



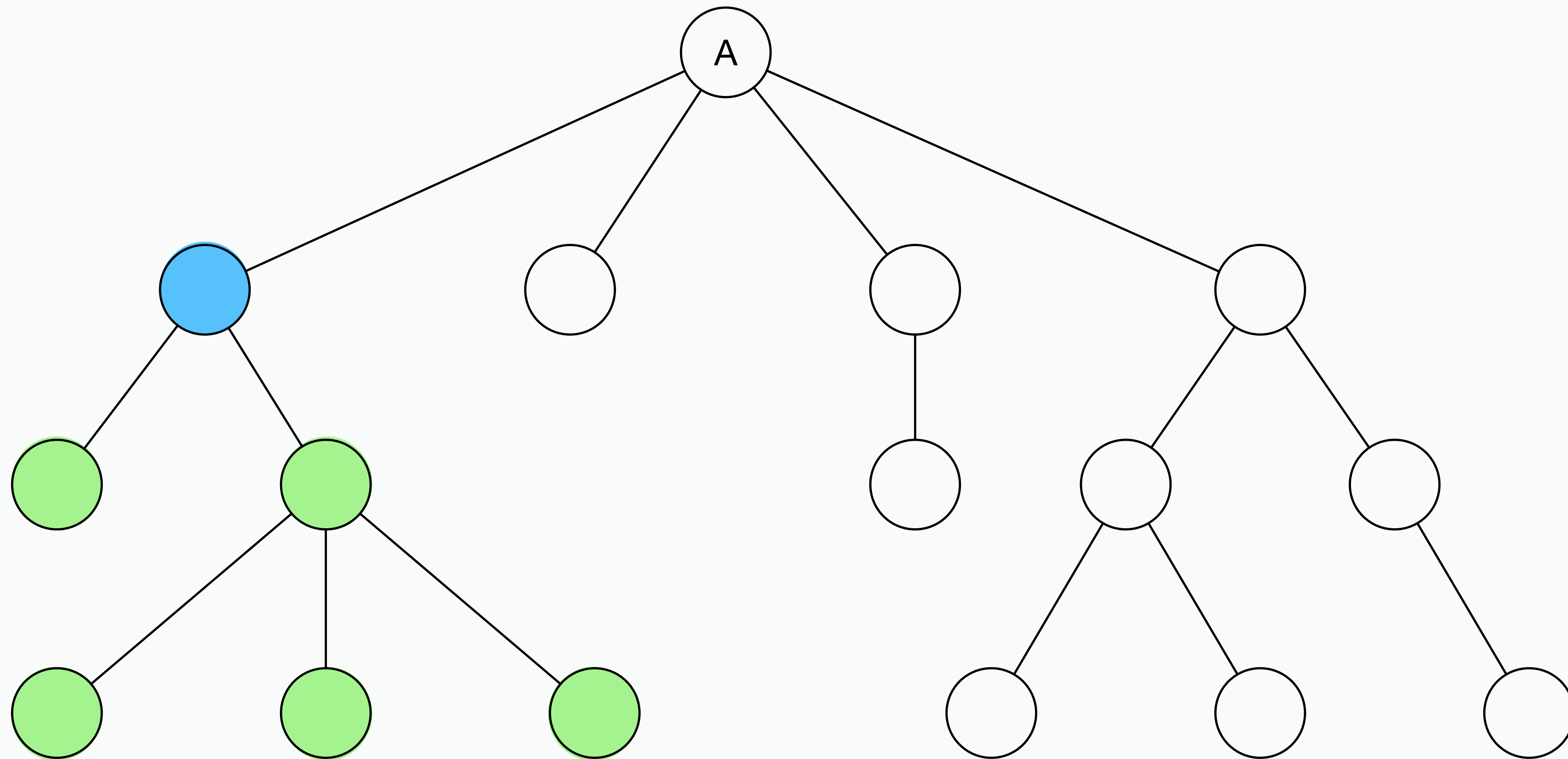
Subtrees

We may refer to a node and its descendants as a .



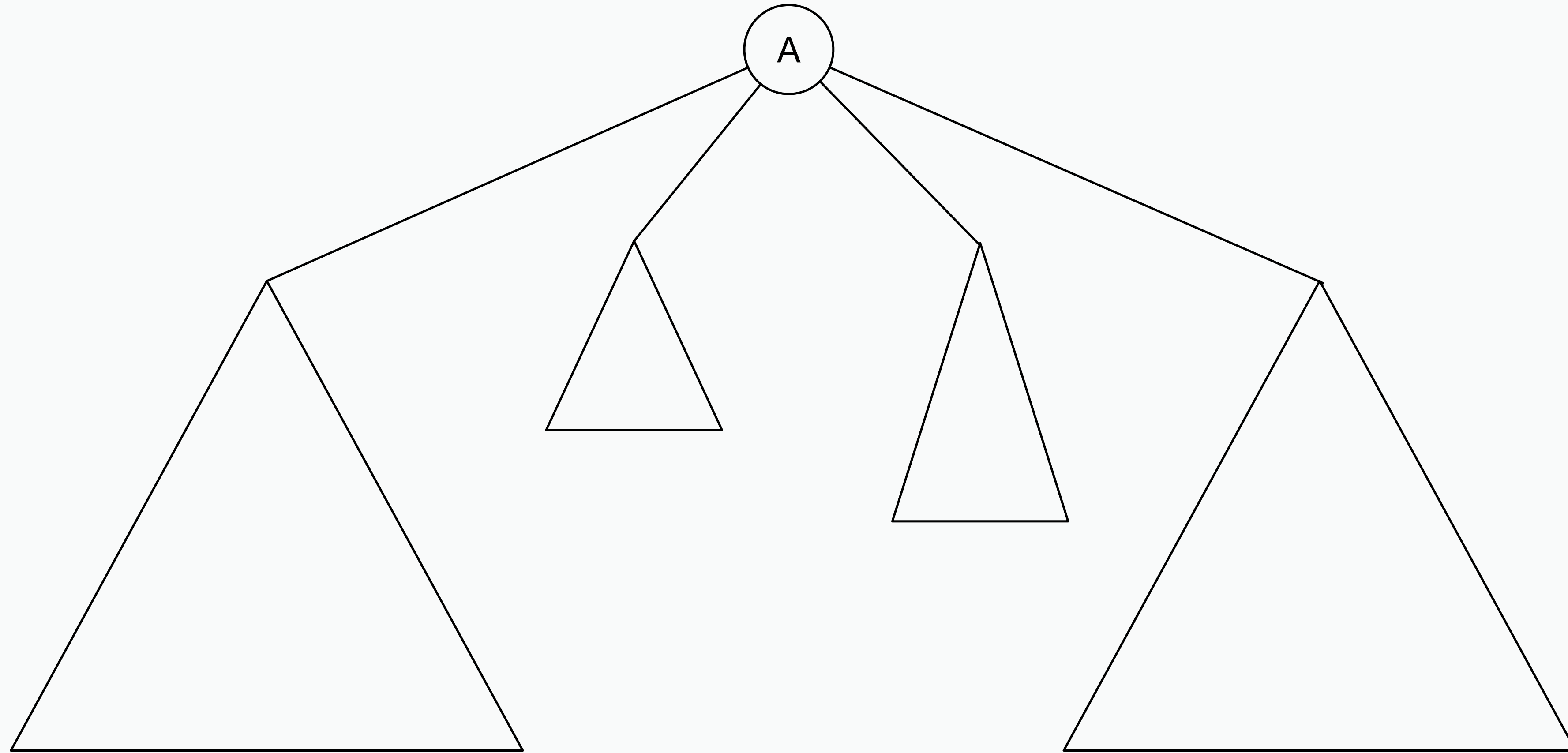
Subtrees

Here is the subtree rooted at B.



Subtrees

Sometimes, when we don't care about detail we just show subtrees as triangles. Here is a tree with four subtrees.

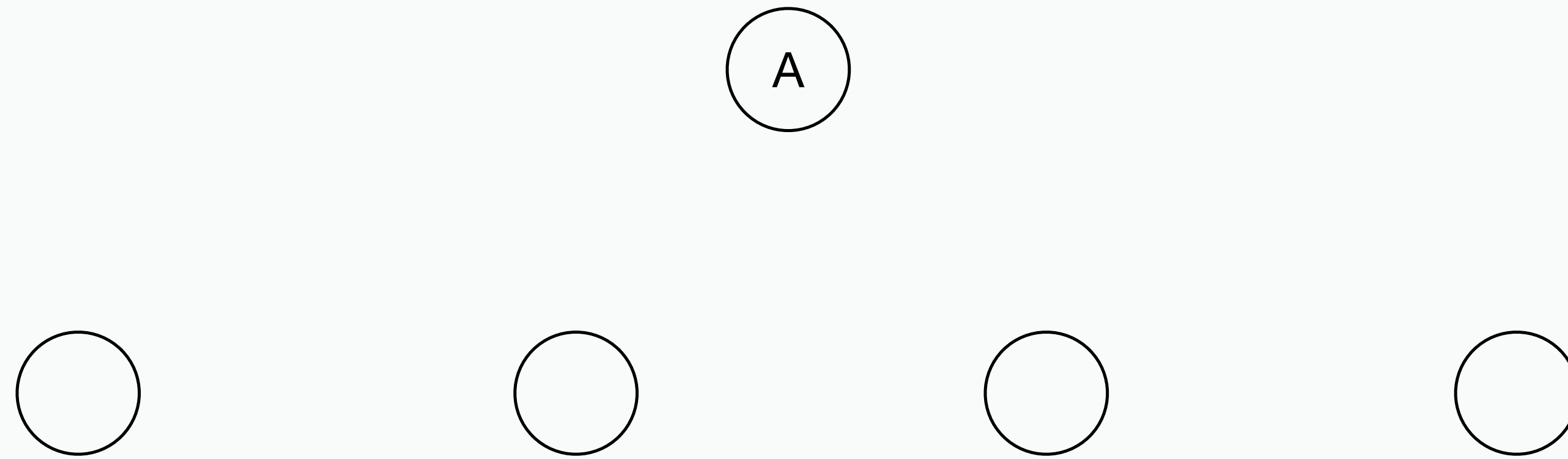


Binary trees

Many of the trees we'll work with are

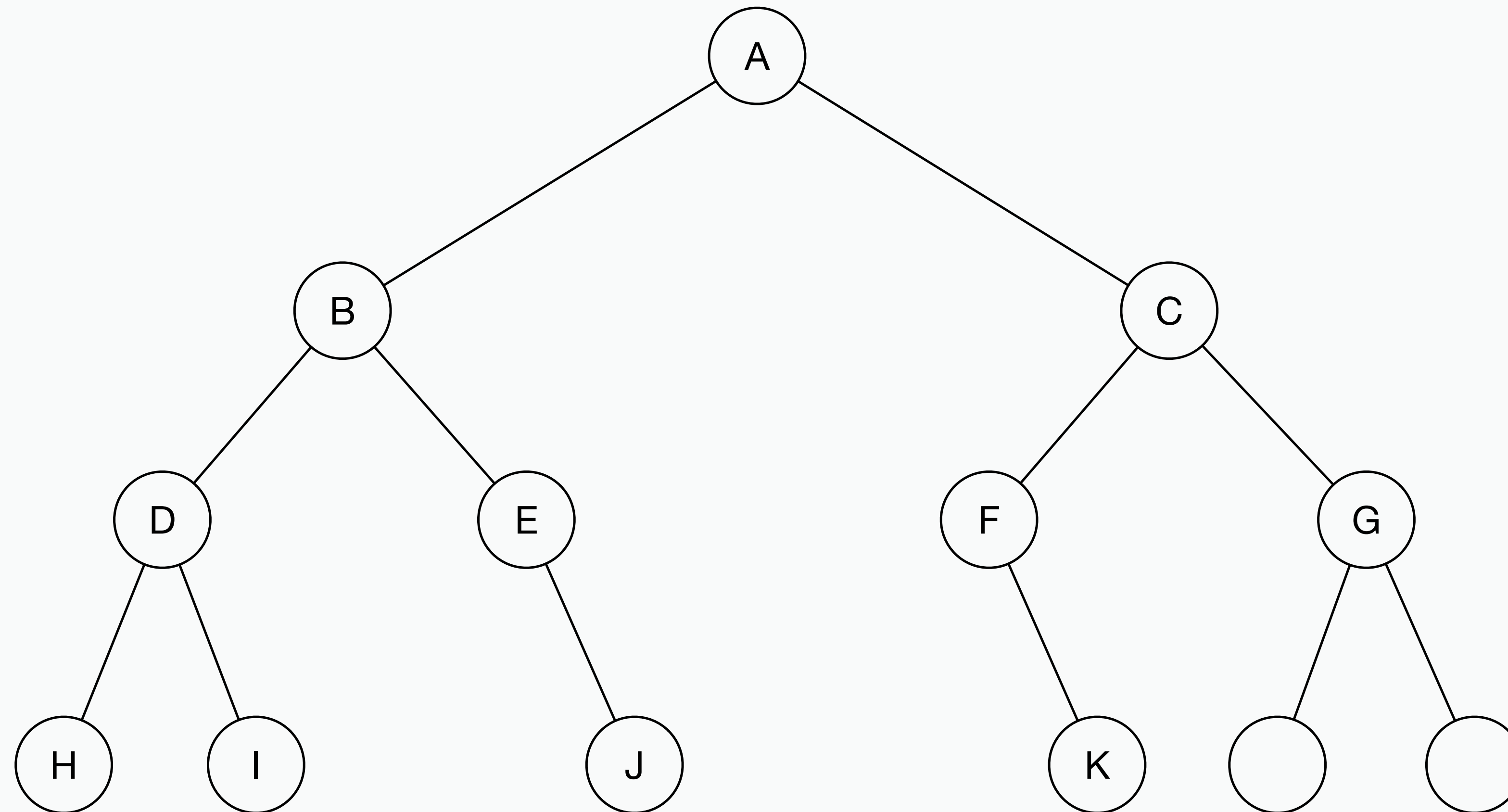
Binary trees

The example we've been using so far is a binary tree.



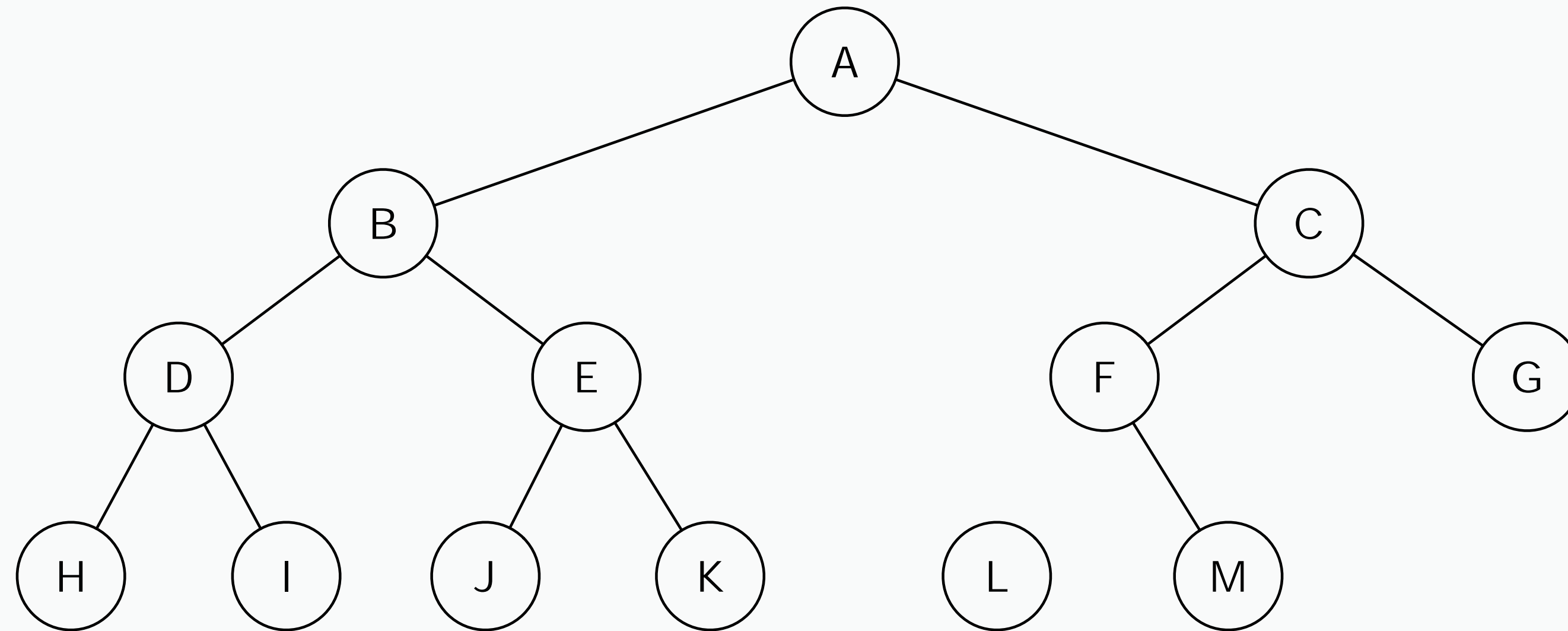
Binary trees

Here's an example of a binary tree.



Binary trees

A **full binary tree** is a binary tree in which each node has either two children or none at all.



Binary trees

A

is a tree in which each level is full, with the possible

Binary trees

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children.

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children."

Are all binary trees full?

Binary tree

Are all trees binary? **NO**

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete?

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**.

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect?

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect? **NO**. The lowest level may not be filled."

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect? **NO**. The lowest level may not be filled."

Are all perfect trees full?

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect? **NO**. The lowest level may not be filled."

Are all perfect trees full? **YES**. Every node in a perfect tree has 0 or 2 children.

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect? **NO**. The lowest level may not be filled."

Are all perfect trees full? **YES**. Every node in a perfect tree has 0 or 2 children."

Can a binary tree have an odd number of nodes?

Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**. Some binary trees have nodes with only one child."

Are all perfect trees complete? **YES**."

Are all complete trees perfect? **NO**. The lowest level may not be filled."

Are all perfect trees full? **YES**. Every node in a perfect tree has 0 or 2 children."

Can a binary tree have an odd number of nodes? **YES**. Sure, why not?

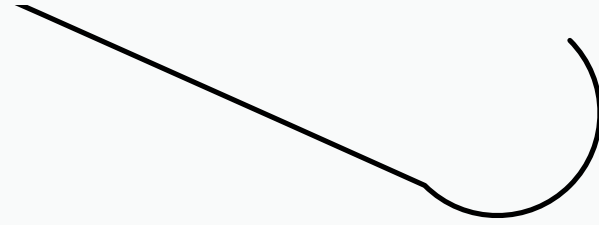
Binary tree

Are all trees binary? **NO**. Some trees have nodes with more than two children?"

Are all binary trees full? **NO**

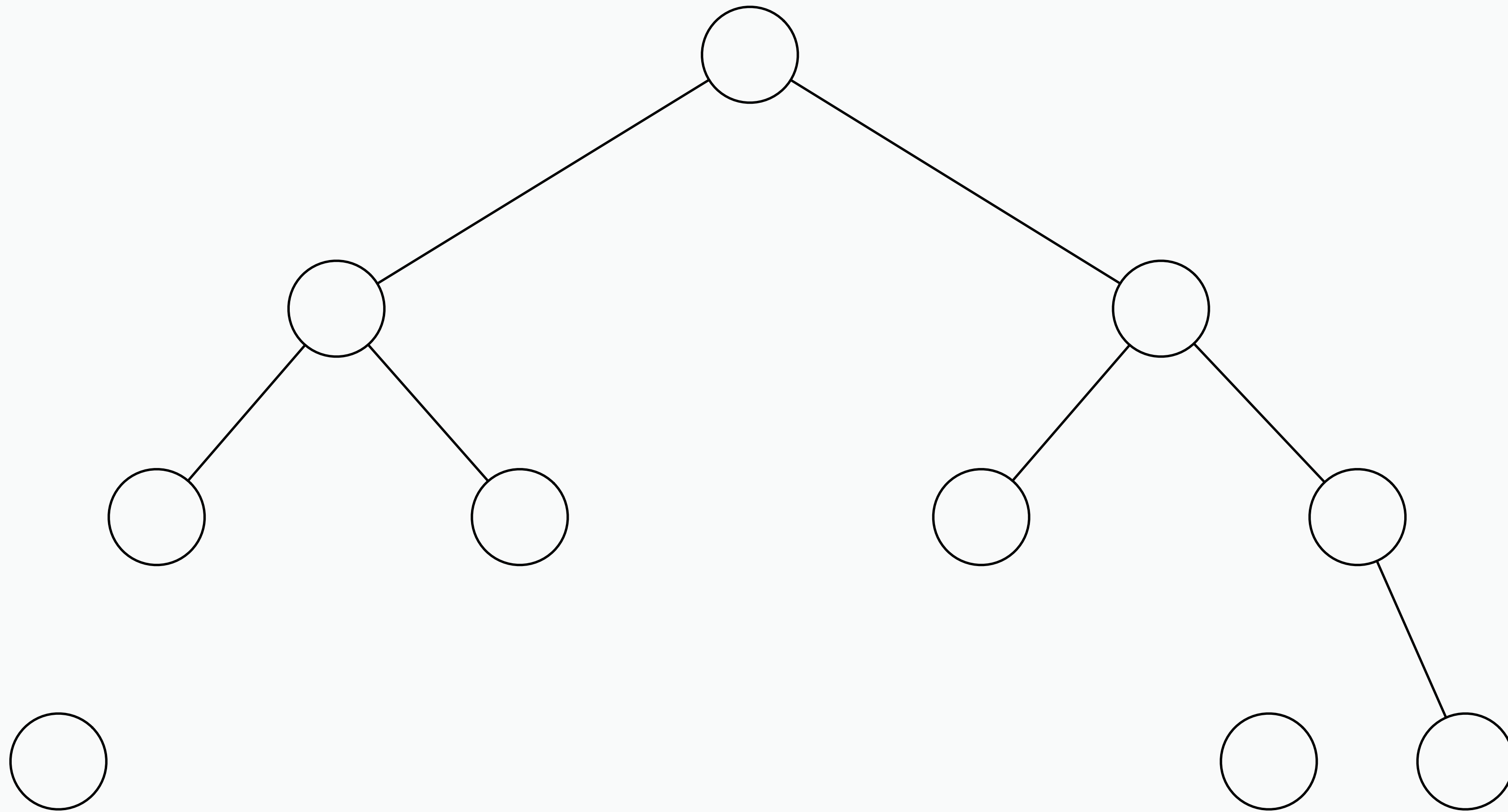
Ordered and unordered trees

Some trees are ordered and some are unordered. This tree is ordered.



Ordered and unordered trees

This tree is unordered.



More to follow...

