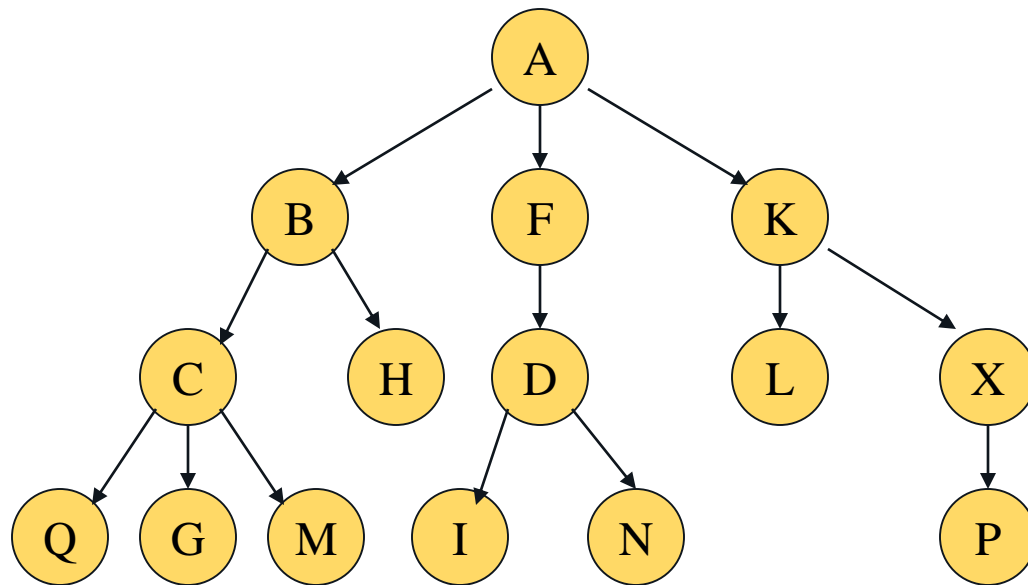# TREES Practice Questions

Tree

- Answer the following questions.
  - What is node and edge in a tree?
  - What is the path and length of the path?
 - Why we need trees, when we have linked lists?

Tree

- Answer Following questions about the given tree?.
  - Label all nodes as root, leaf or intermediate node?
  - What is the degree of each node?
  - What is the degree of the tree?
  - What is the height and depth of the tree?
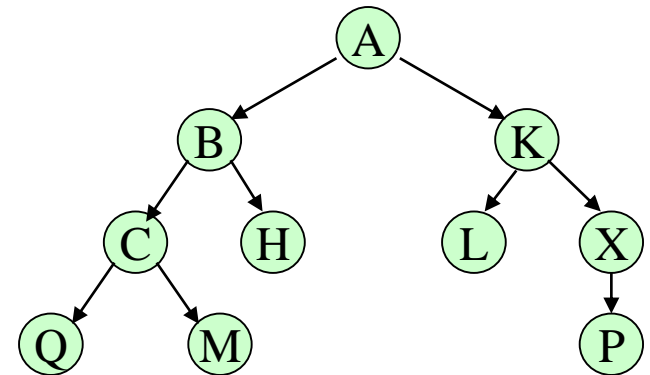 - What is height and depth of node A, F, L and P?
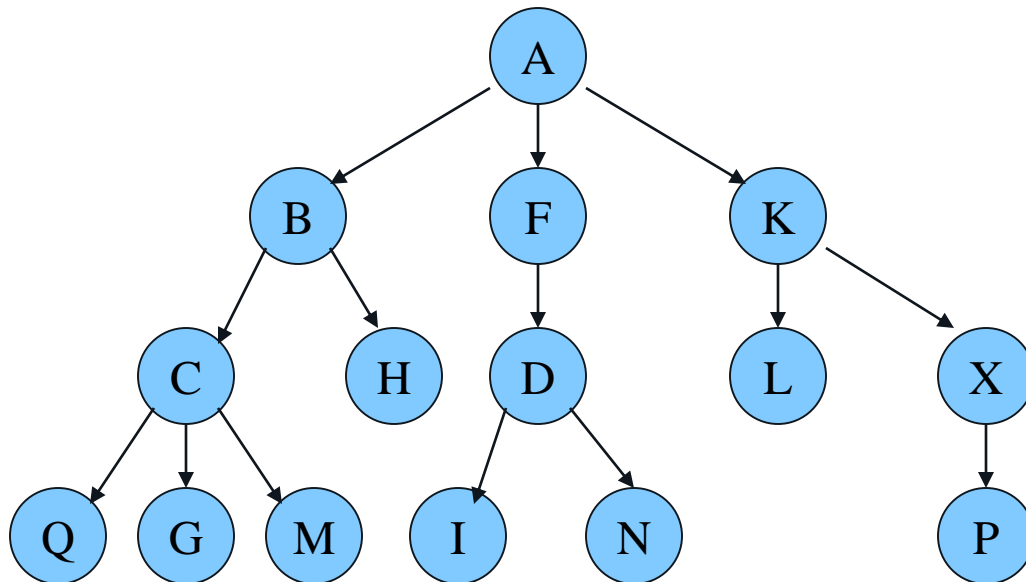
- For each node in the tree
  - a. Name the parent node.
    b. List the children.
    c. List the siblings.
    d. Compute the depth.
    e. Compute the height
- What is the depth of the tree?
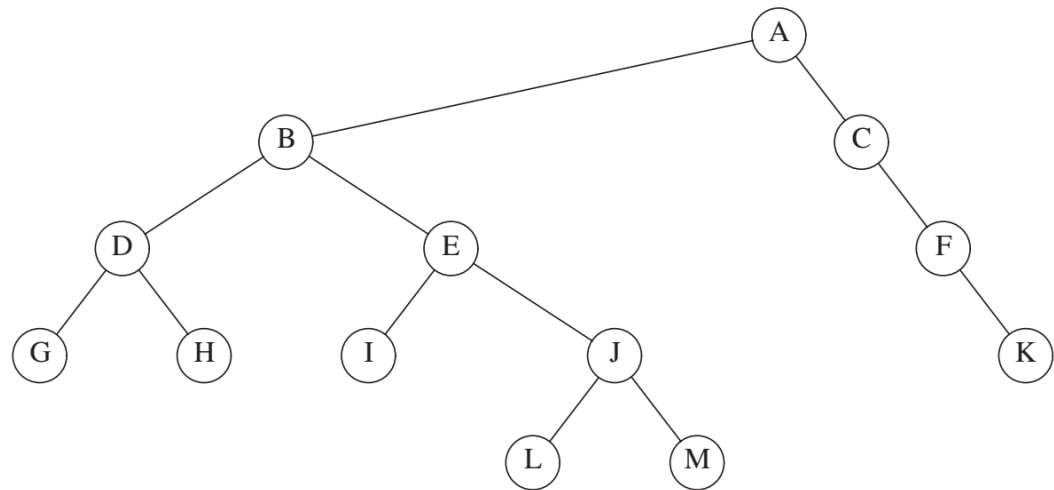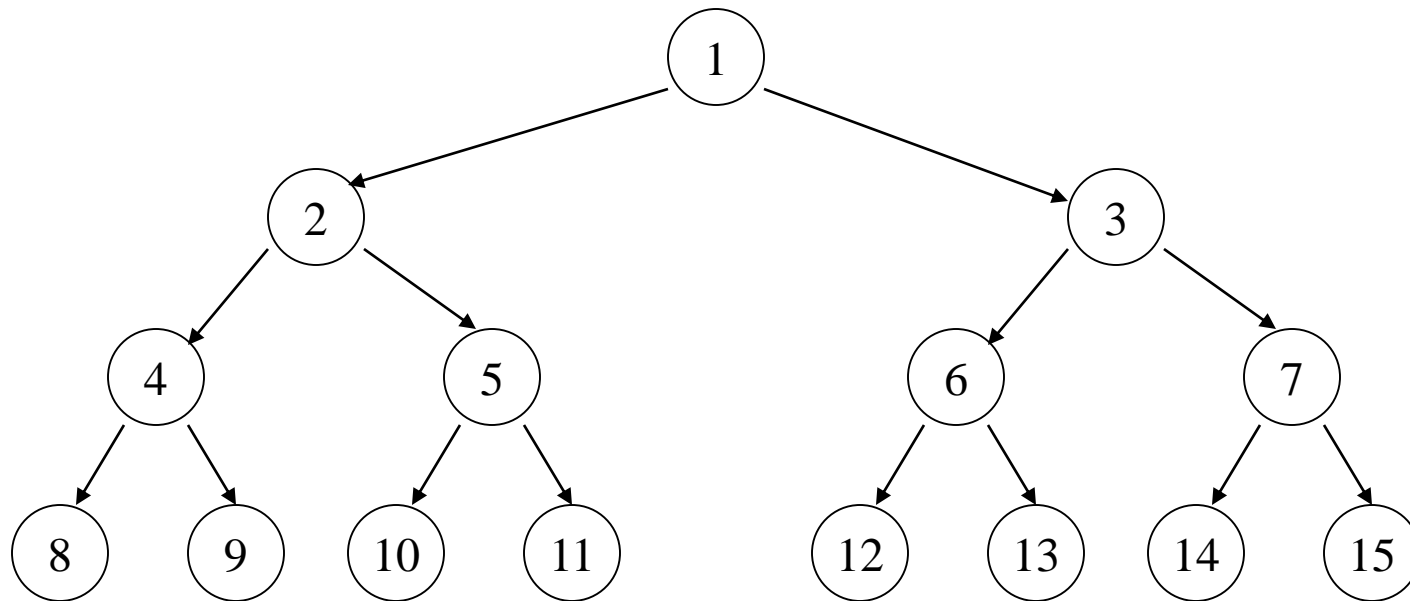
BINARY TREES

- ## What is a binary tree?

- ## The maximum number of nodes on level i of a binary tree is 2^i
  - WHY ?

- ## The maximum number of nodes in a binary tree of height k is $2^{k+1} - 1$
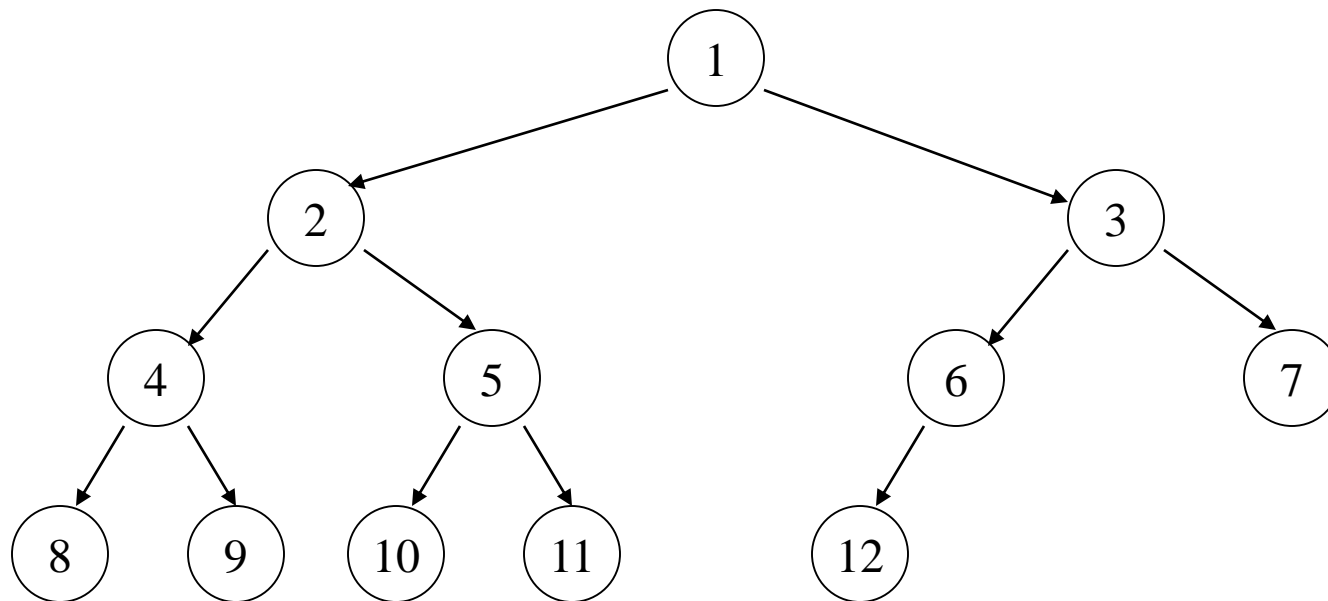 - WHY ?

Full Binary Tree

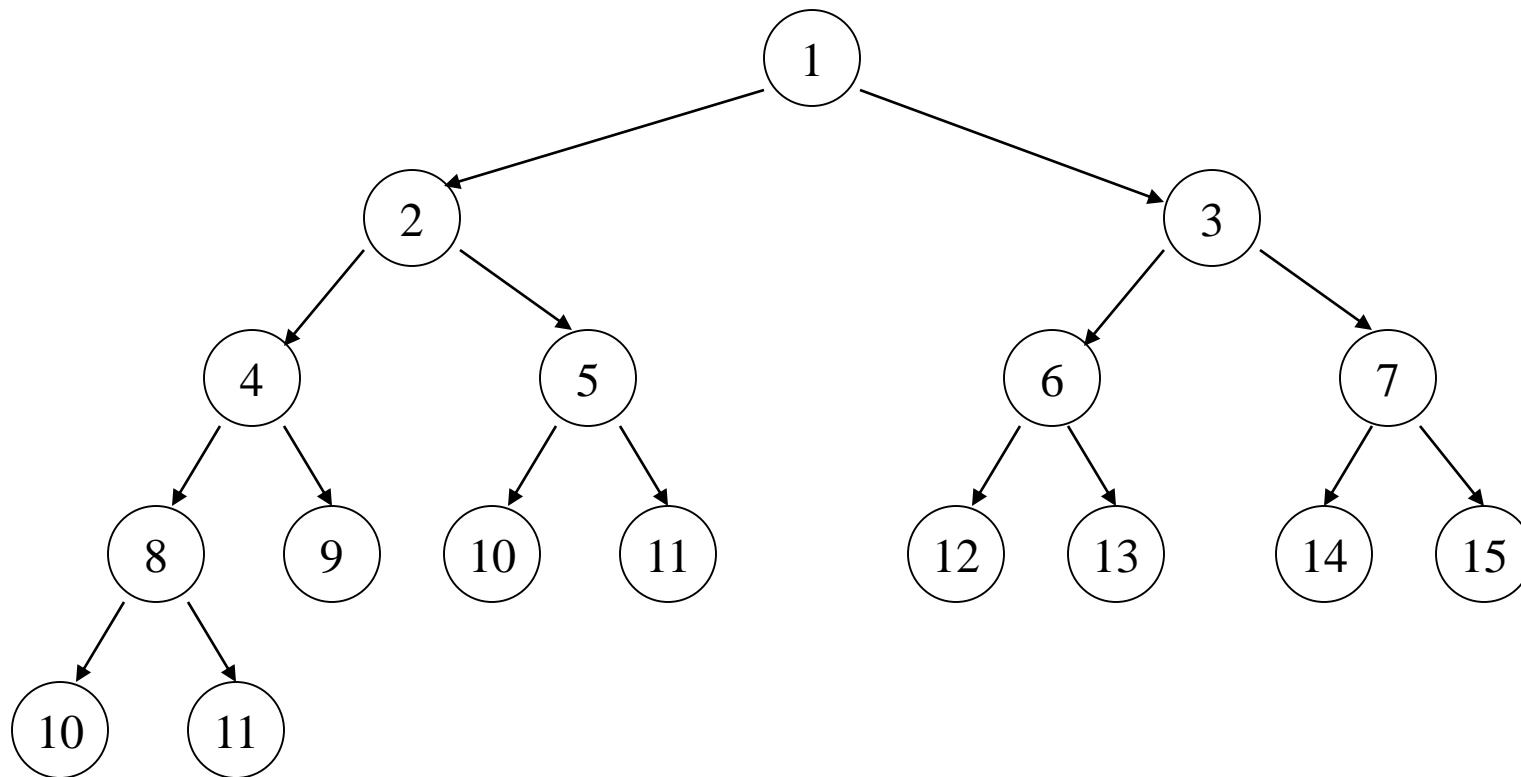A binary tree of height k having $2^{k+1} - 1$ nodes is called a *full* binary tree

Complete Binary Tree

A binary tree that is completely filled, with the possible exception of the bottom level, which is filled from left to right, is called a *complete* binary tree
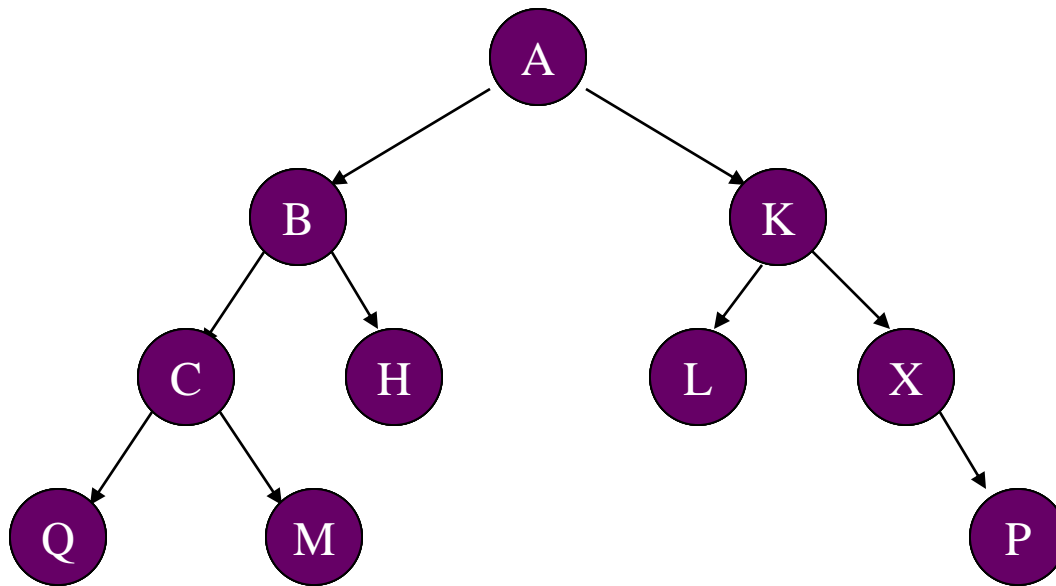
Complete Binary Tree

Is it a complete binary tree?

Give the output of in-order, pre-order and post-order traversal of the following binary tree

Binary Search Trees Questions

- What is BST? Why we need one ?

- Show the result of inserting 3, 1, 4, 6, 9, 2, 5, 7 into an initially empty binary search tree.

- Show the result of deleting the root of above tree.

Binary Search Trees Questions

- **How to insert a node in BST ?**
- **How to delete a node from BST ?**
- **Search for a given value.**
- **Print Tree (In-order Traversal)**
- **Destructor (Post-order Traversal)**
- **Copy Constructor (Pre-order Traversal)**

You should be able to give Recursive as well as Iterative Code for these
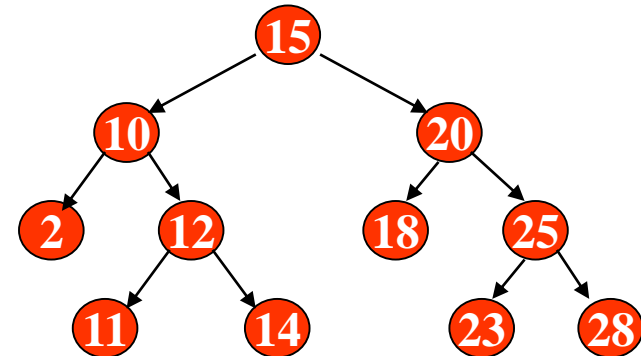
BST Questions

- Write Recursive as well as Iterative functions for the following:
- COUNTs
  - Function to count number of nodes in given BST
  - Function to count the number of leaves
  - Function to count the number of right children
  - Function to find the height of the tree
- Write a function to delete all leaves from a binary tree
- Write a function to Find Minimum value
- Write a function to Find Maximum Value

BST Questions

- Write a function that checks whether a binary tree is perfectly balanced

- **Write function bool IsComplete();** The function should check if the tree is complete or not.

- Divide a binary search tree into two trees, one tree with key < K and the other tree with keys ≥ K, where K is any key in the tree.

- Design an algorithm to test whether a binary tree is a binary search tree

  – SOLUTION: Test condition at each node and also keep track of upper and lower limit for the subtree

- Write a function to print the BST in descending order

- Write a function to flip the BST
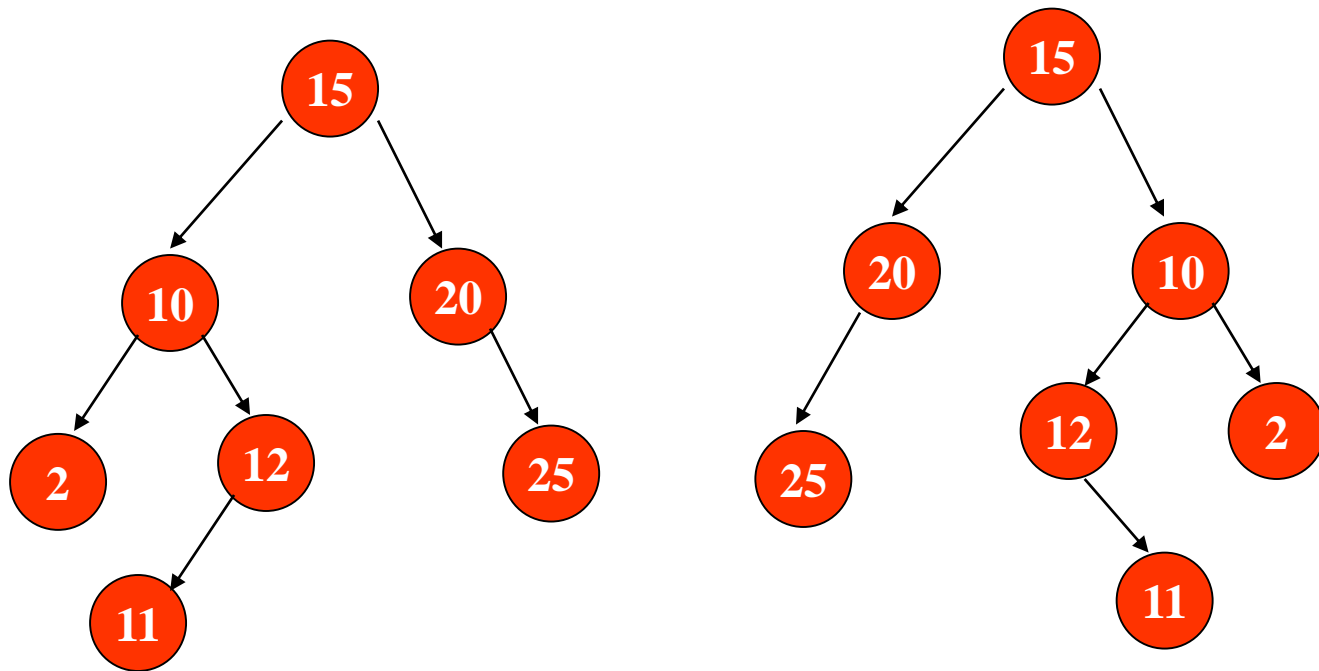
BST Questions

- A *full node* is a node with two children. Prove that the number of full nodes plus one is equal to the number of leaves in a nonempty binary tree

- Using inorder, preorder, and postorder tree traversal, visit only leaves of a tree. What can you observe? How can you explain this phenomenon?

- In *lazy deletion,* nodes to be deleted are retained in the tree and only marked as deleted. What are the advantages and disadvantages of this approach?

Comparison of Link List & BST

Best and Average case

Operation	BST	Link List
Constructor	O(1)	O(1)
Destructor	O(N)	O(N)
Search	$O(\log_2 N)$	O(N)
Insert	$O(\log_2 N)$	O(N)
Delete	$O(\log_2 N)$	O(N)