Threaded Binary Trees

Speeding up traversals

Objectives

- In this session, you will learn to
  - Threaded binary tree

Defining Threaded Binary Trees

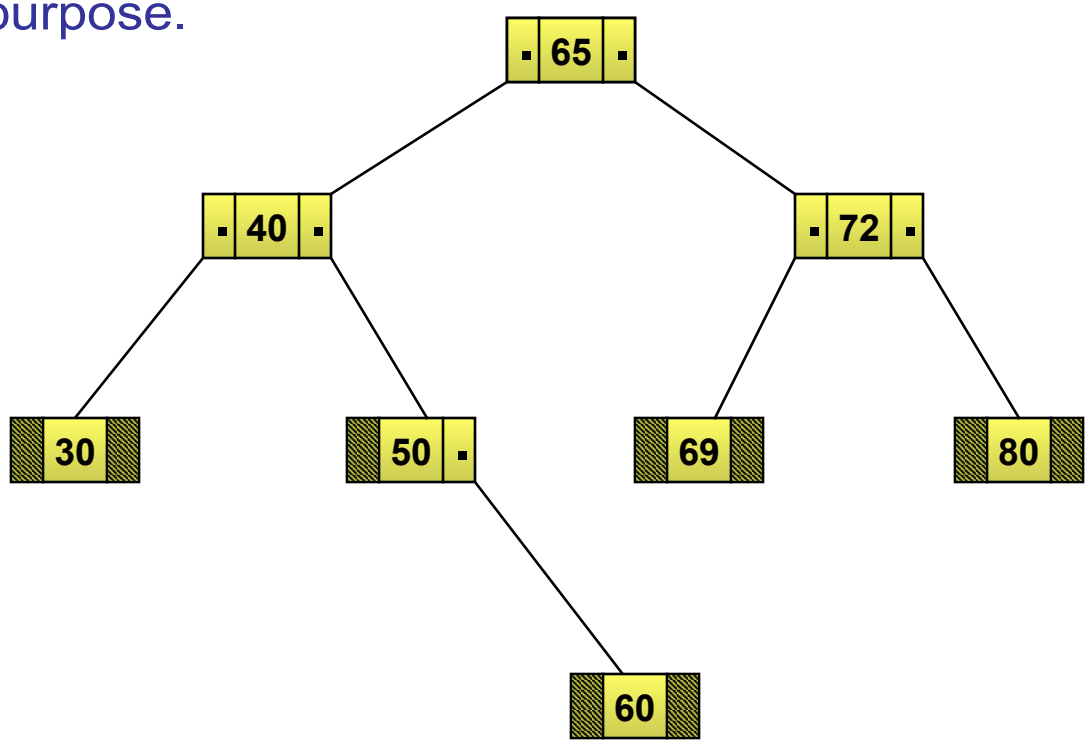
- In a binary search tree, there are many nodes that have an empty left child or empty right child or both.
- You can utilize these fields in such a way so that the empty left child of a node points to its inorder predecessor and empty right child of the node points to its inorder successor.

Threaded binary Tree

- One way threading:- A thread will appear in a right field of a node and will point to the next node in the inorder traversal.
- Two way threading:- A thread will also appear in the left field of a node and will point to the preceding node in the inorder traversal.

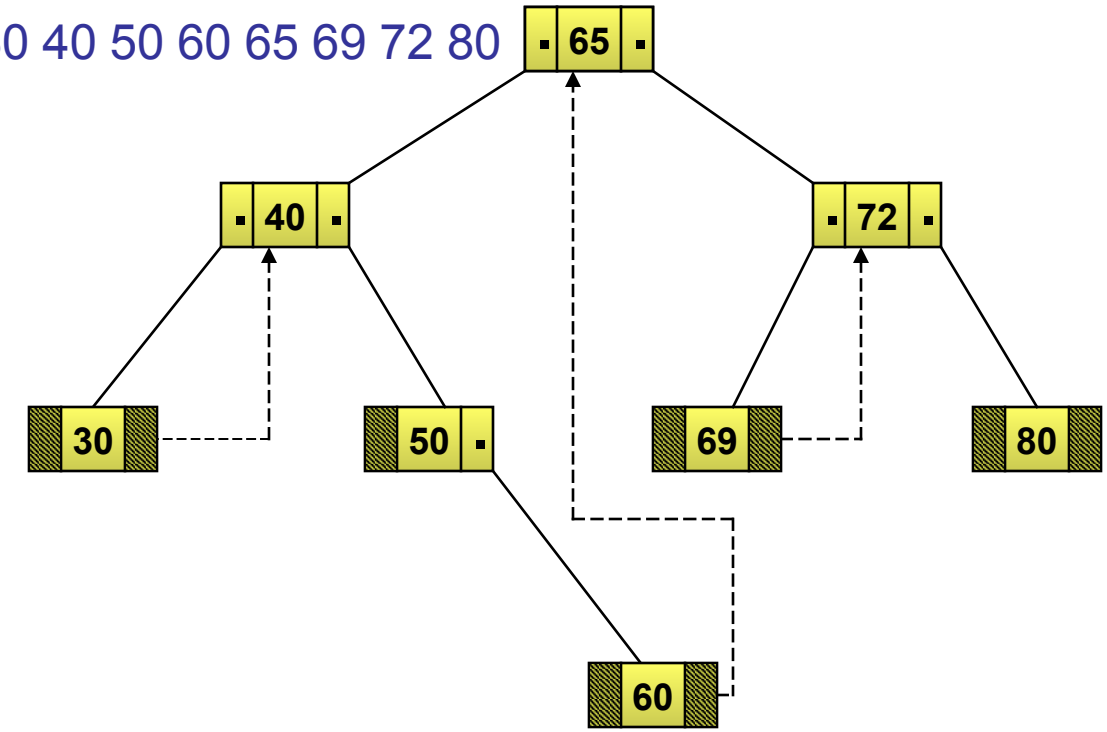
Defining Threaded Binary Trees

- Consider the following binary search tree.
- Most of the nodes in this tree hold a NULL value in their left or right child fields.
- In this case, it would be good if these NULL fields are utilized for some other useful purpose.



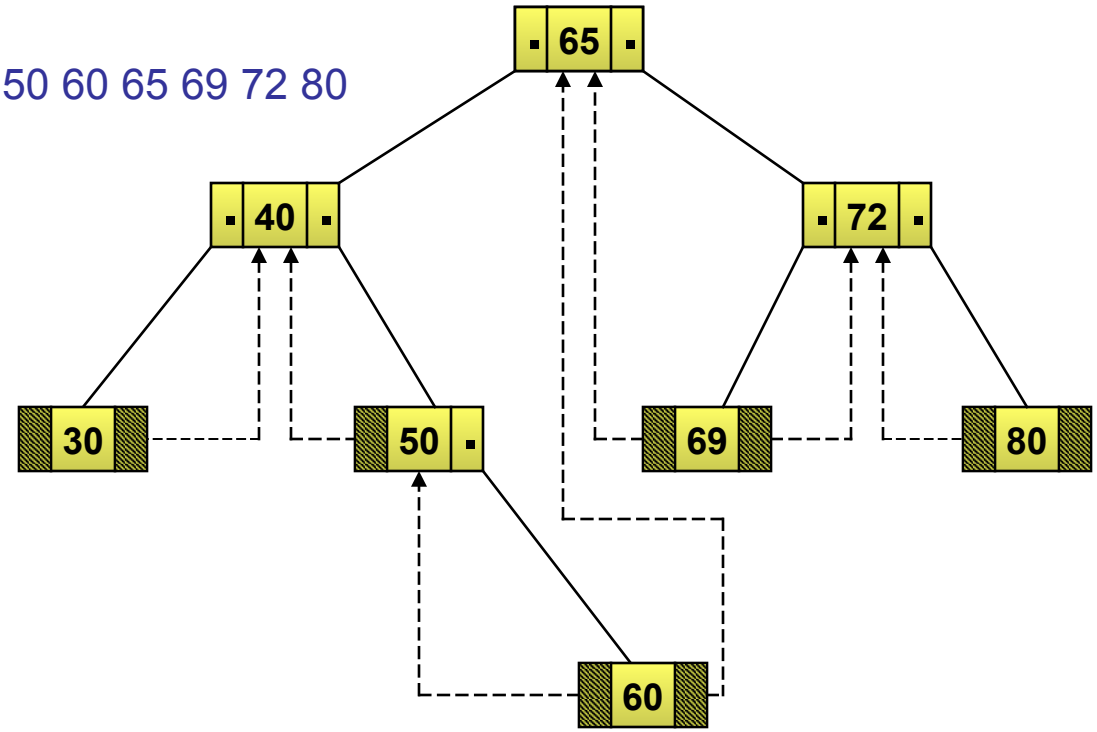
One Way Threaded Binary Trees

- The empty left child field of a node can be used to point to its inorder predecessor.
- Similarly, the empty right child field of a node can be used to point to its in-order successor.
- Such a type of binary tree is known as a one way threaded binary tree.
- A field that holds the address of its in-order successor is known as thread.
- In-order :- 30 40 50 60 65 69 72 80

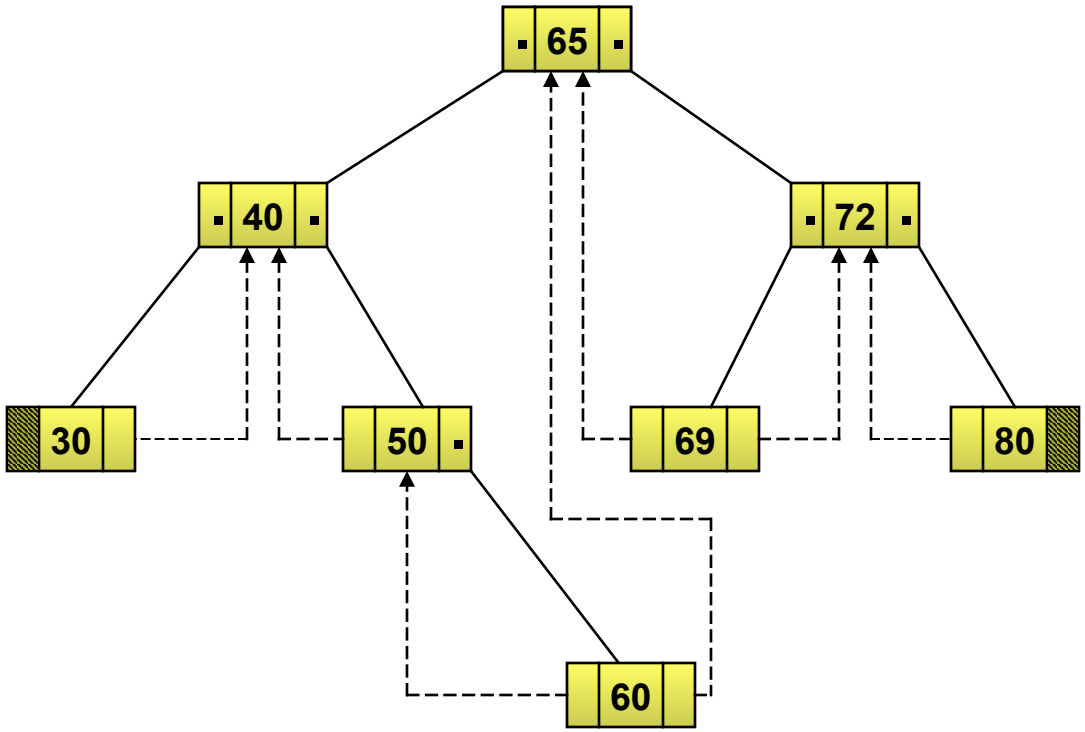


Two way Threaded Binary Trees

- Such a type of binary tree is known as a threaded binary tree.
- A field that holds the address of its inorder successor or predecessor is known as thread.
- The empty left child field of a node can be used to point to its inorder predecessor.
- Similarly, the empty right child field of a node can be used to point to its inorder successor.
- Inorder :- 30 40 50 60 65 69 72 80

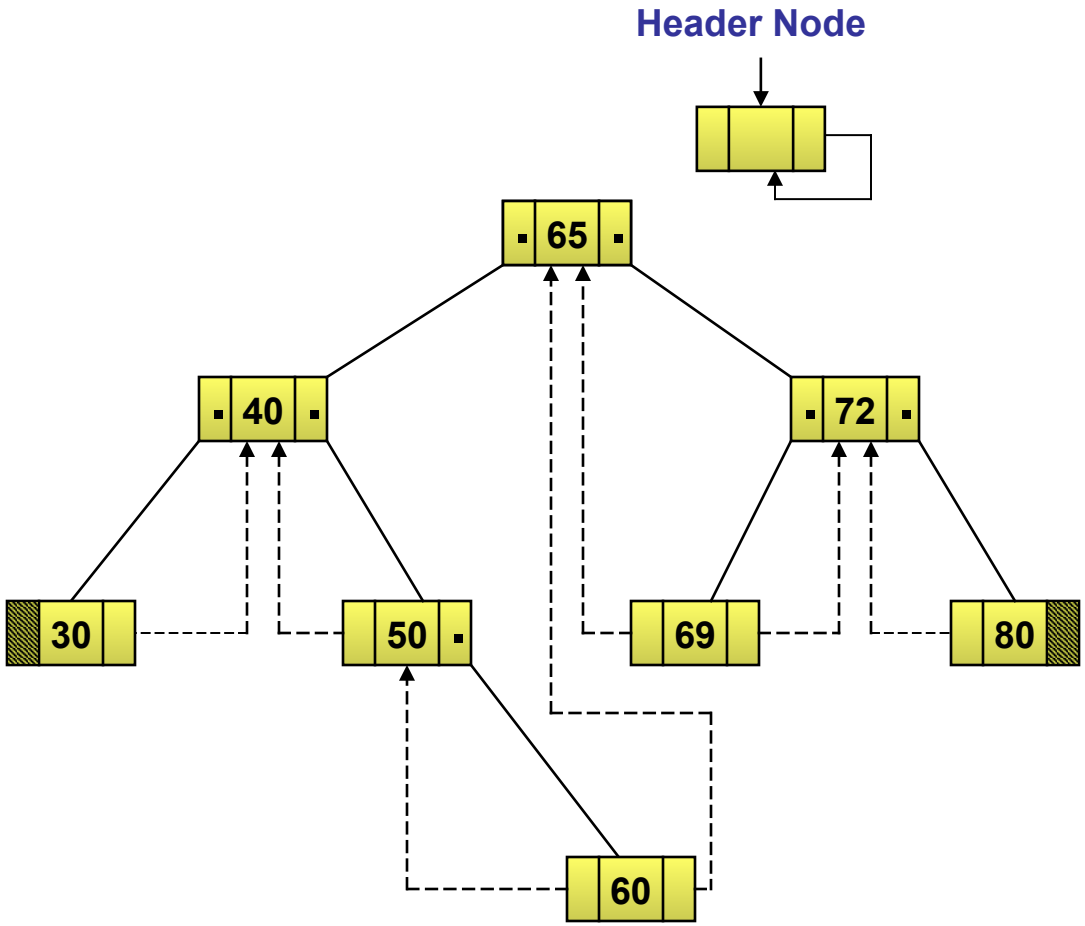


- Node 30 does not have an inorder predecessor because it is the first node to be traversed in inorder sequence.
- Similarly, node 80 does not have an inorder successor.

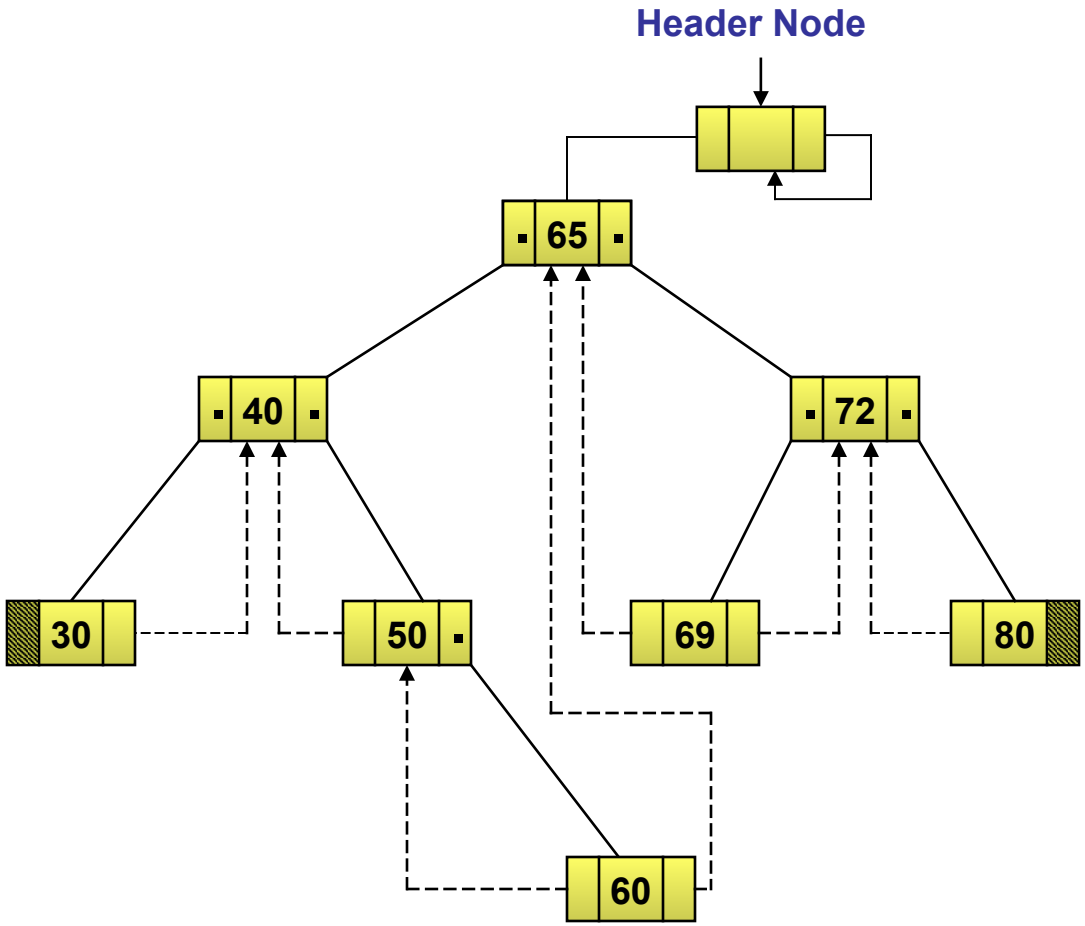


Two way Threaded Binary Trees with header Node

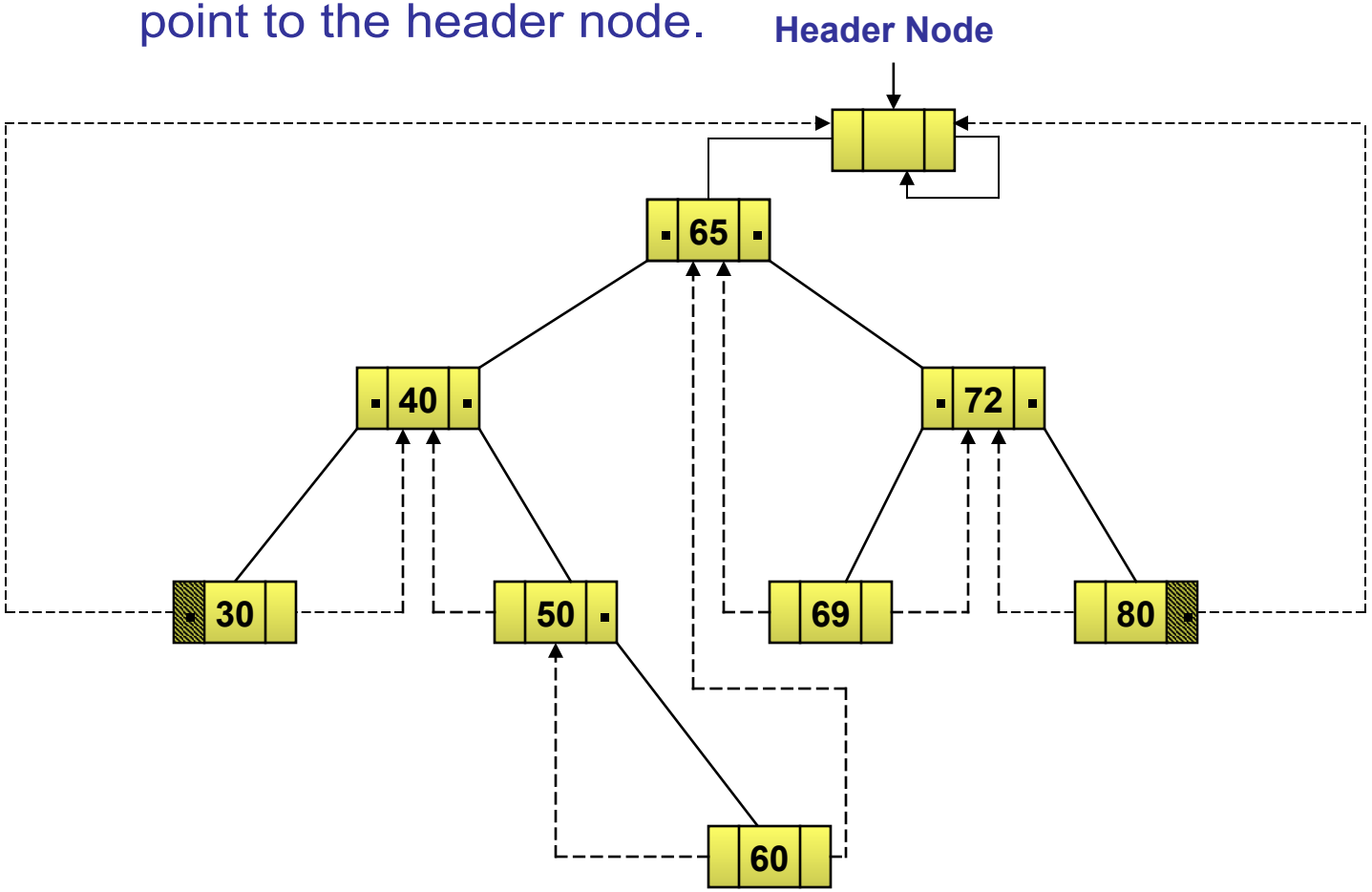
- The right child of the header node always points to itself.
- Therefore, you take a dummy node called the header node.



- The threaded binary tree is represented as the left child of the header node.

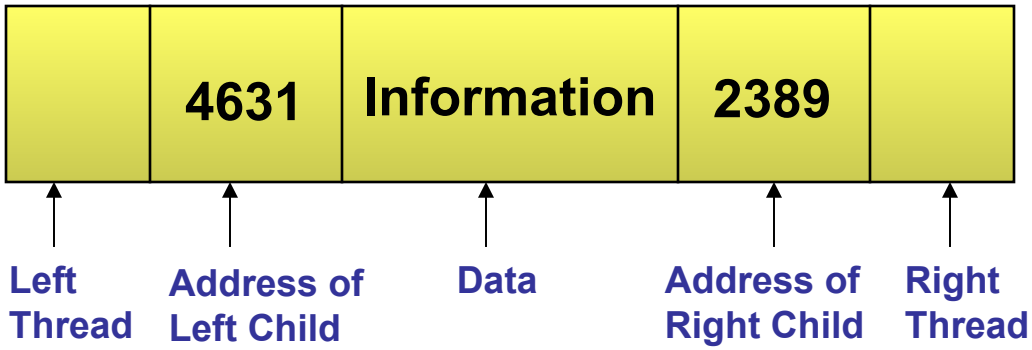


- The left thread of node 30 and the right thread of node 80 point to the header node.



Representing a Threaded Binary Tree

- The structure of a node in a threaded binary tree is a bit different from that of a normal binary tree.
- Unlike a normal binary tree, each node of a threaded binary tree contains two extra pieces of information, namely left thread and right thread.
- The left and right thread fields of a node can have two values:
  - **1**: Indicates a normal link to the child node
  - **0**: Indicates a thread pointing to the inorder predecessor or inorder successor



- In a threaded binary tree, the right thread of a node points to its inorder _____, and the left thread points to its inorder _____.

- Answer:
  - successor, predecessor