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.
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