Concurrent Internal Binary Search Trees

Arunmoezhi Ramachandran
Supervisor - Neeraj Mittal

The University of Texas at Dallas

Overview

Local recovery

Local recovery[PPoPP'16 Poster]

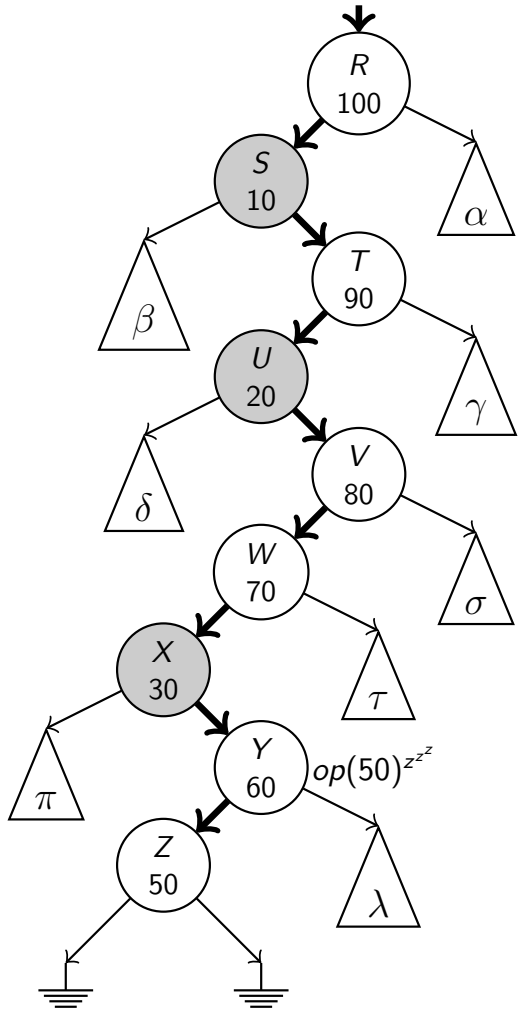
Overview

- a general technique for local recovery for concurrent BSTs
- reduces tree traversal cost during failures by restarting closer to an operations window

Motivation

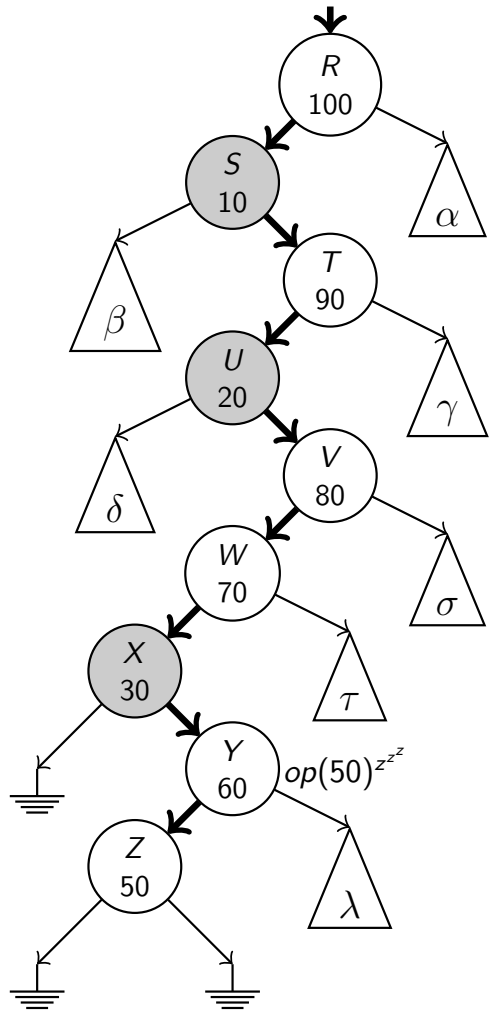
- in most concurrent BSTs, execution phase of an operation have constant time complexity
- seek phase is where an operation may end up spending most of its time (esp for large trees)
- this technique reduces the seek time

Example



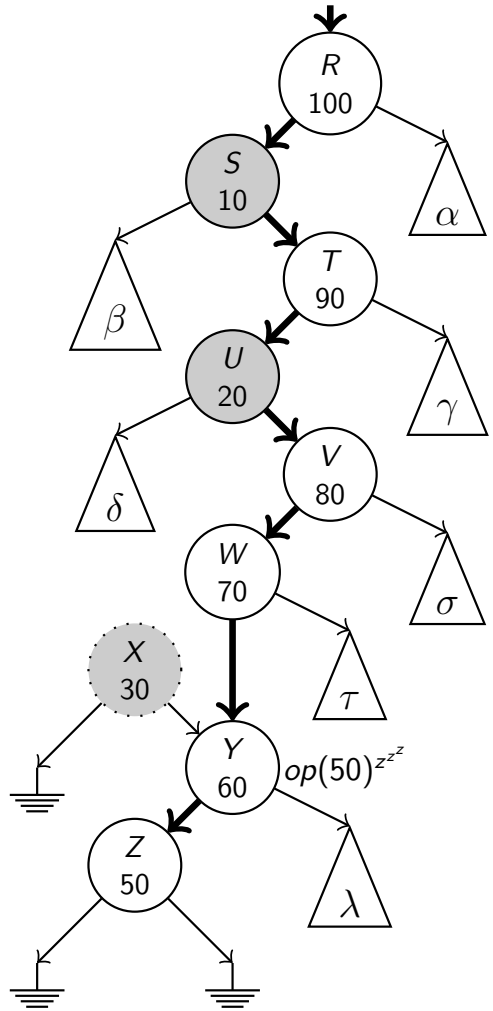
Operation $op(50)$ is suspended at node Y during its traversal

Example



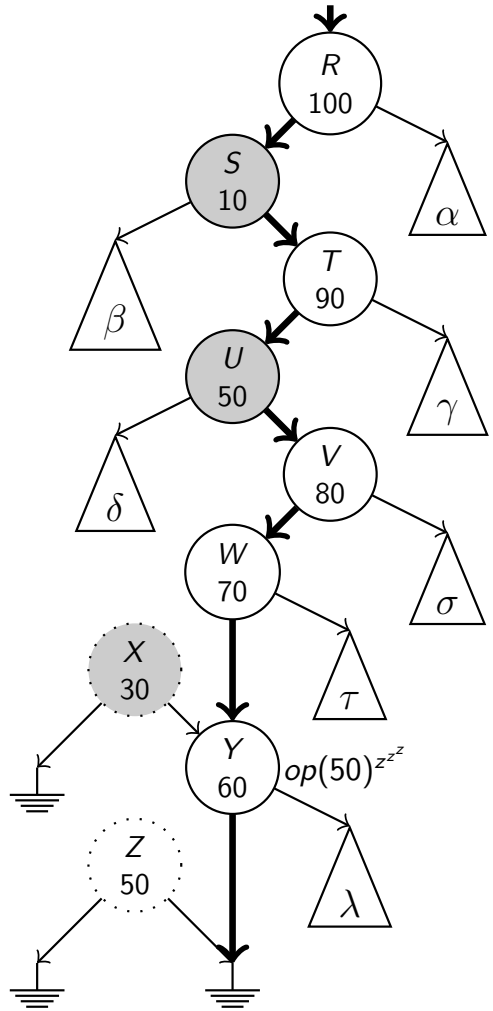
All keys in subtree π are deleted one-by-one

Example



Key 30 is deleted (simple delete); node X is removed

Example

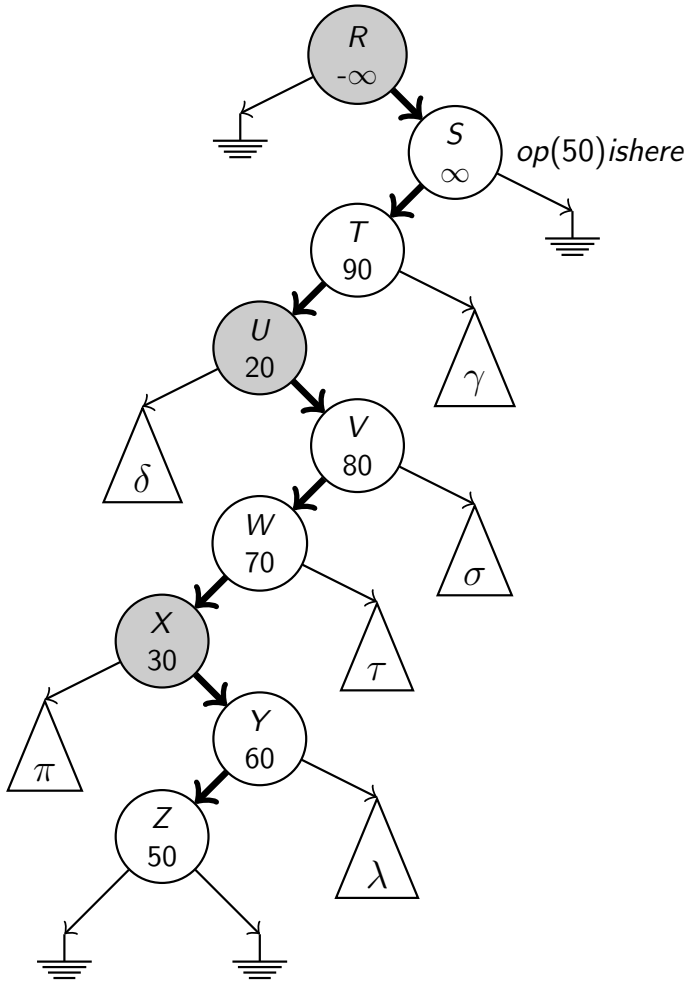


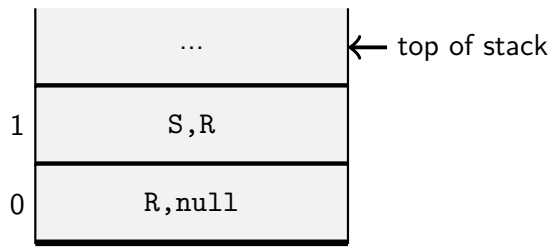
Key 20 is deleted (complex delete); key 20 is replaced with key 50 in node U and node Z is removed

Traversal Stack

- a stack
- reduces tree traversal cost during failures by restarting closer to an operations window

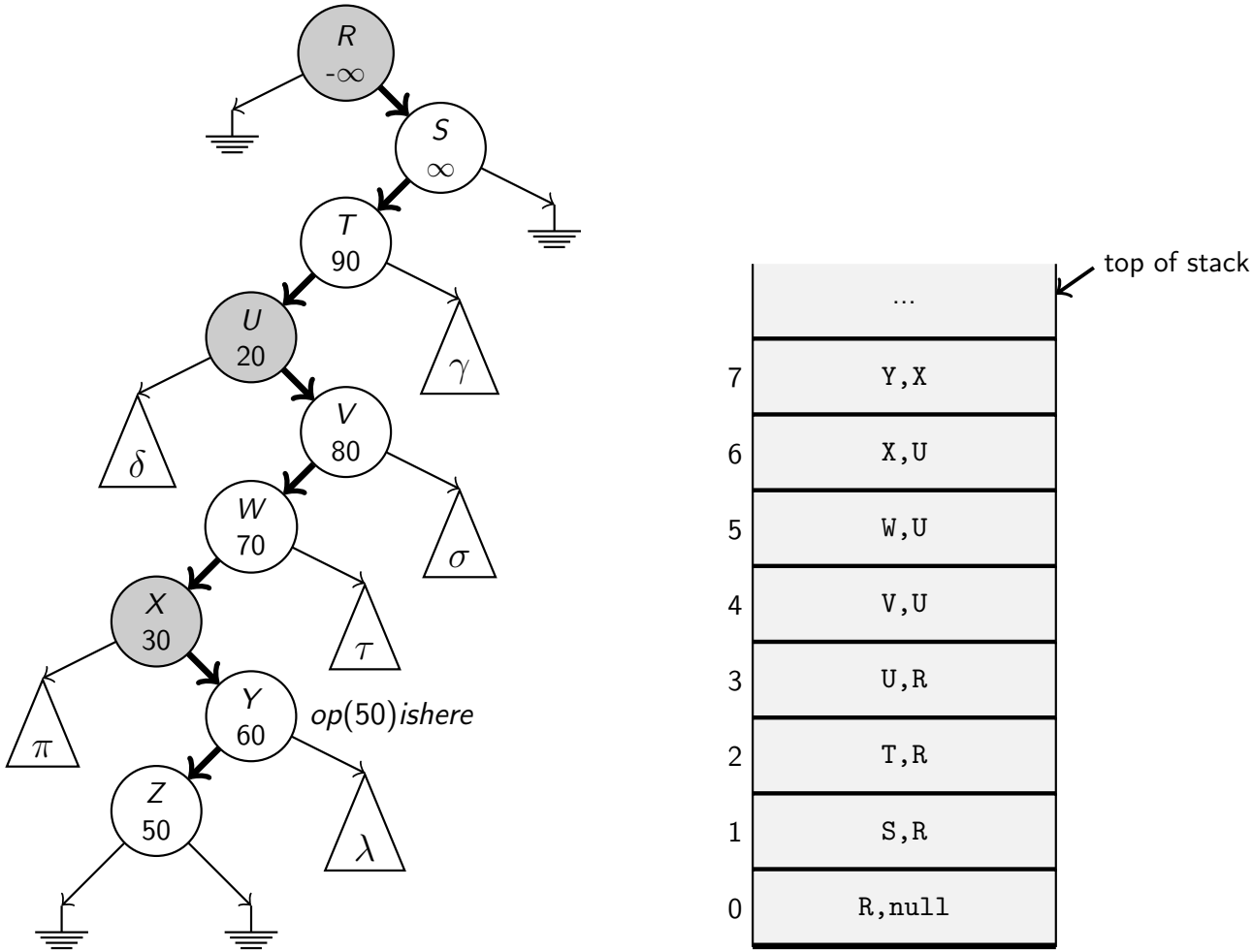
Traversal Stack





Operation *op*(50) starting at R and ending at Z along with the stack

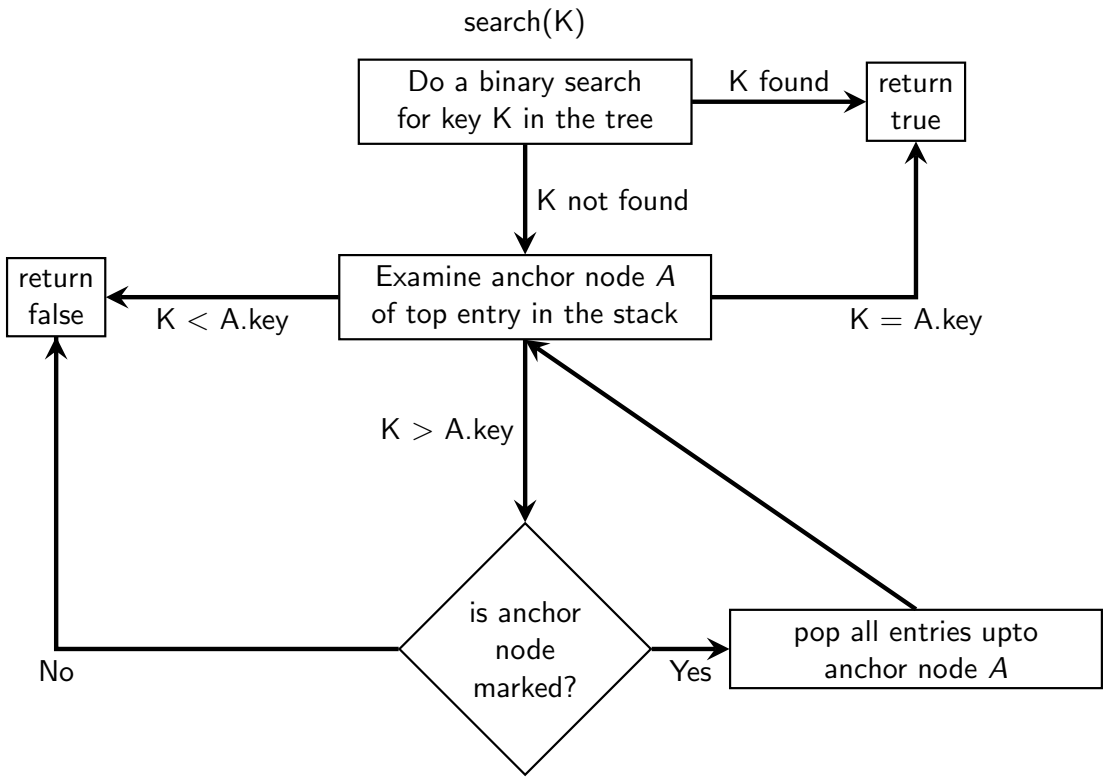
Traversal Stack



Operation *op*(50) starting at R and ending at Z along with the stack

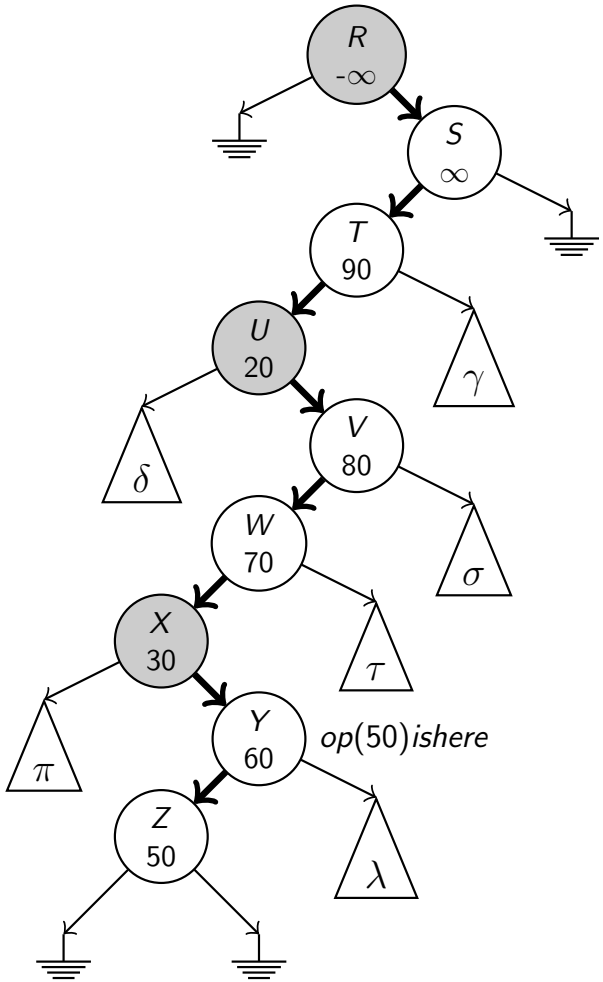
Search

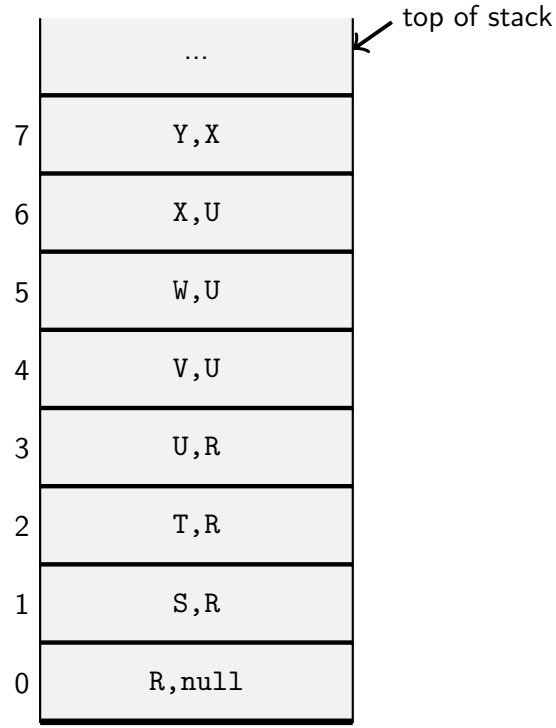
search operations do not restart



Sequence of steps in a search operation

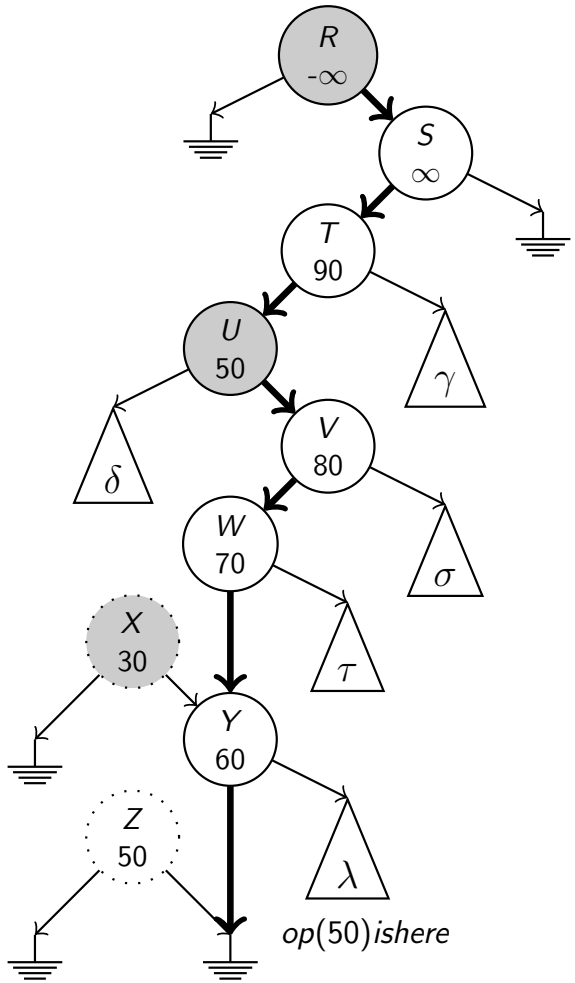
Search

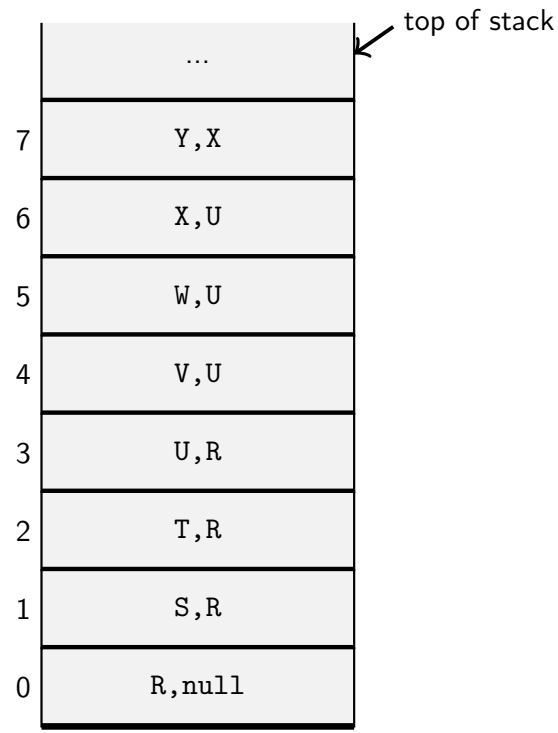




Operation *op*(50) starting at R and ending at Z along with the stack

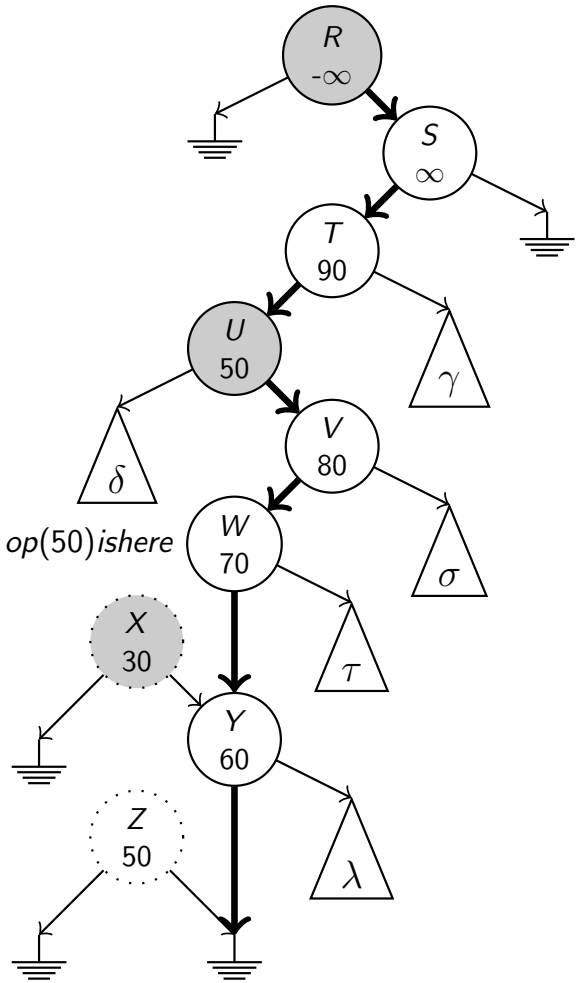
Search

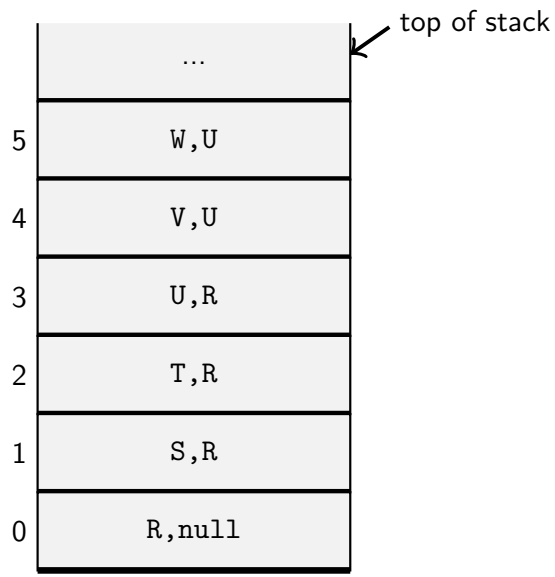




Key 20 is deleted (complex delete); key 20 is replaced with key 50 in node U and node Z is removed

Search

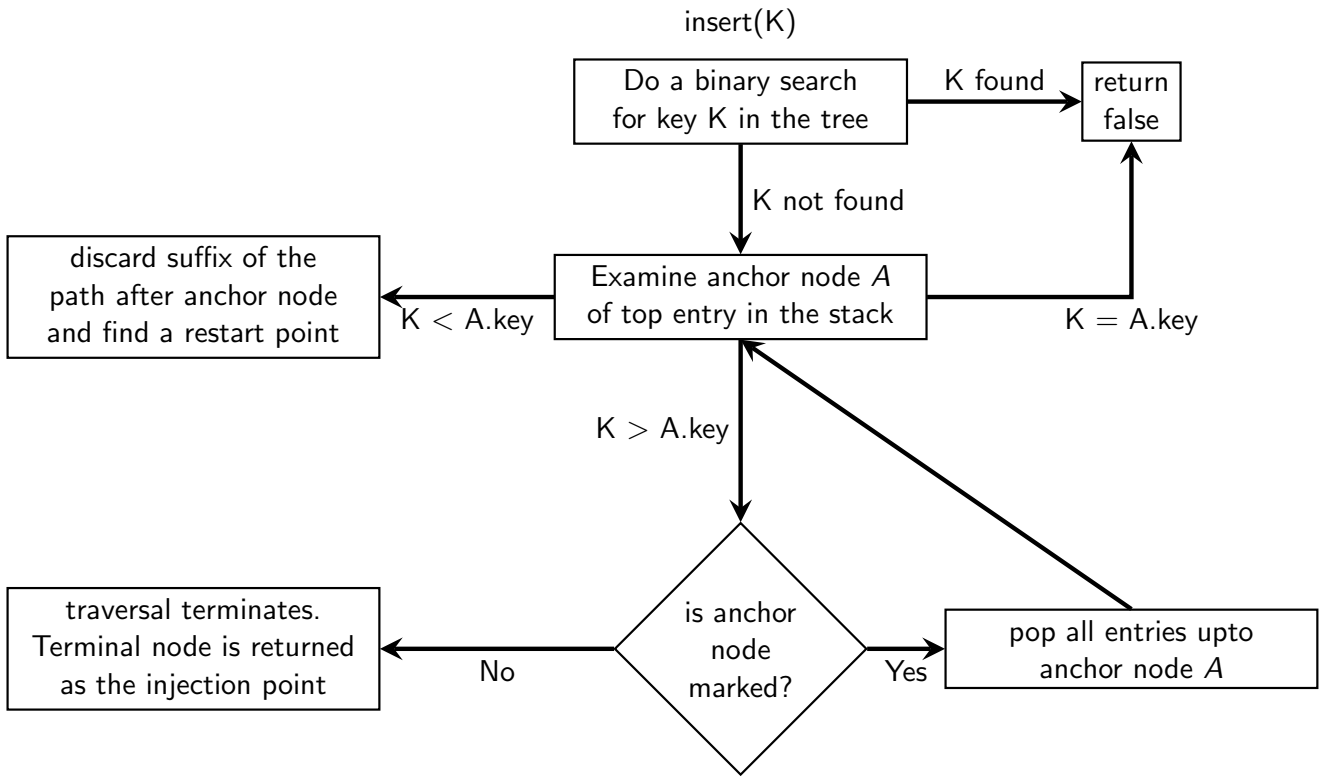




Pop upto marked anchor node X. Top of stack is now W. Examine anchor node U

Insert

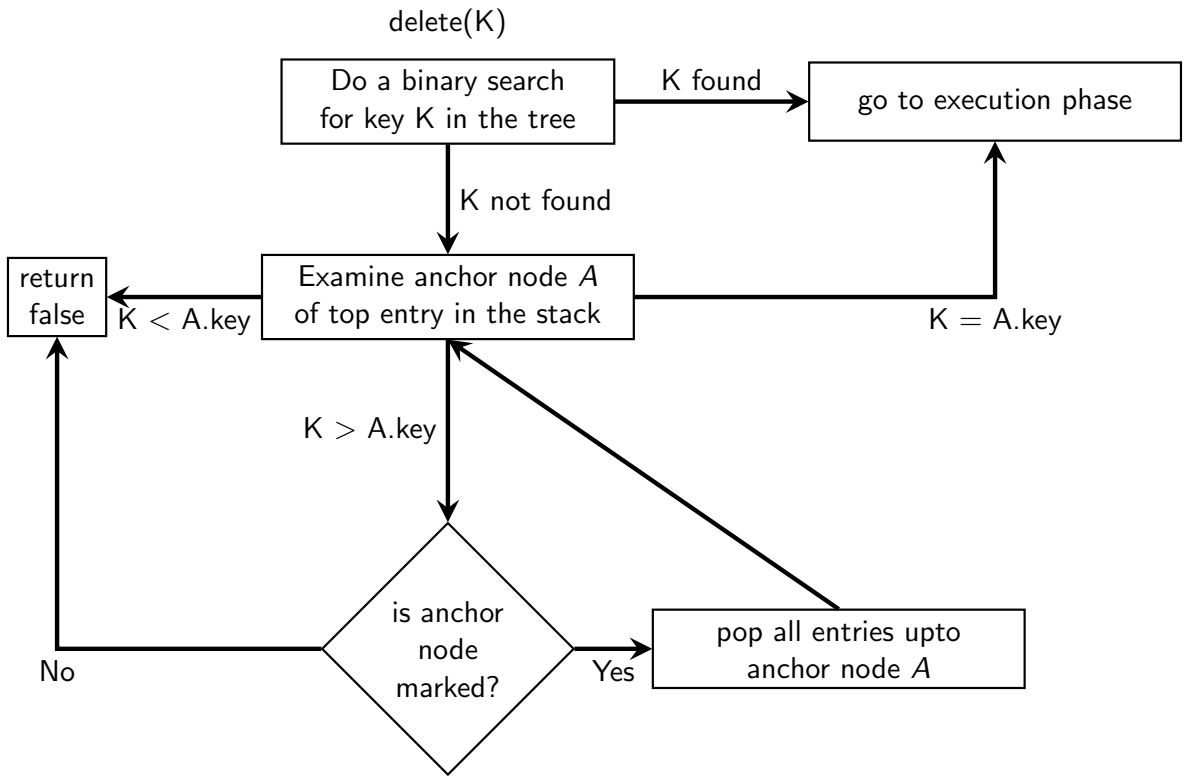
An insert operation needs to restart only if one of the anchor nodes in the path has become inconsistent



Sequence of steps in an insert operation

Delete

A delete operation do not restart except when there is a failure in the execution phase



Sequence of steps in a delete operation