C343 / SUMMER 2020

Lecture Task - 22

July 29, 2020

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MST (Minimum Spanning Trees)

The MST satisfies the optimal substructure property.

- Let T be an MST of G, and e an edge (u, v) in T
- Removing $e\ (u, v)$ will partition T into two trees
  - T_1 and T_2

Prim's algorithm

pseudocode:

Maintain $V - A$ as a priority queue Q. Key each vertex in Q w/ the weight of the least-weight edge connecting it to a vertex in A.

```
$Q \leftarrow V$
$Key[v] \leftarrow \infty$ for all $v \in V$
$Key[s] \leftarrow 0$ for some arbitrary $s \in V$

while $Q \neq \emptyset$
    do $u \leftarrow$ Extract-Min($Q$)
    for each $v \in Adj[u]$
        do if $v \in Q$ and $w(u, v) < Key[v]$
            then $Key[v] \leftarrow w(u, v)$
                $\pi[v] \leftarrow u$
```

At the end, $\{(v, \pi[v])\}$ forms the MST.

Prim's algorithm is a greedy algorithm. We can show that it works correctly by,

- Cycle property
- Cut Property

Kruskal's Algorithm

NOT ON EXAM

Binary Tree Traversals

- Any process for visiting all of the nodes in some order is called traversal.
- Any traversal that lists every node in the tree exactly once is called an enumeration of the tree's node.
- 3 common tree traversals :
  - Inorder
  - Preorder
  - Post order
- Time complexity : $\Theta(n)$

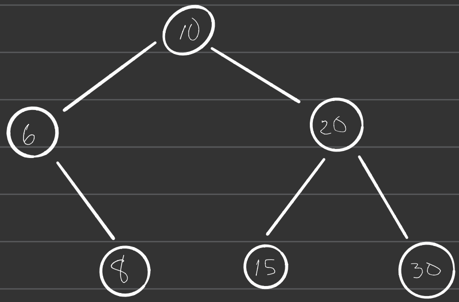
BST

BST property : All nodes stored in the left subtree of a node whose Key values less than K. In other words, all nodes stored in the right subtree of a node whose Key values is K have key values greater than or equal to K.

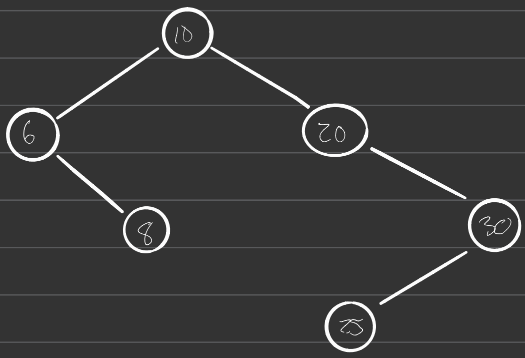
AVL Trees

Property : The subtrees of every node differ in height by at most one.

Example of BST + AVL :



Example of BST, but not AVL:



How do AVL trees work? Adding or removing a leaf from an AVL tree may make many nodes violate the AVL balance condition, but each violation of AVL balance can be restored by one or two single changes called rotations.