Traversal, Tries & Heaps

Exam Prep 09

Announcements

Week 9

- ❏ HW3 party this Saturday 2-5pm (see ed for details)
- ❏ Project 2B due this Friday
- ❏ No lab this week

Content Review

Trees

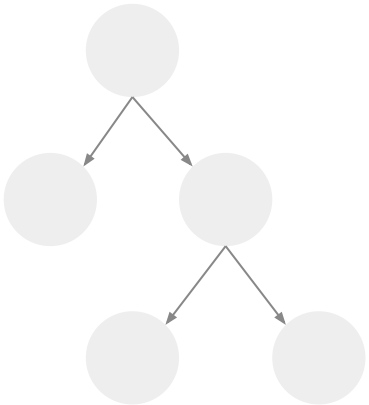
Trees are structures that follow a few basic rules:

1. If there are N nodes, there are N-1 edges
2. There is exactly 1 path from every node to every other node
3. The above two rules means that trees are fully connected and contain no cycles

A parent node points towards its child.

The root of a tree is a node with no parent nodes.

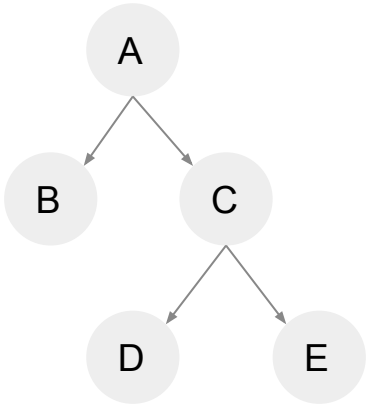
A leaf of a tree is a node with no child nodes.



Breadth First Search

Breadth first search means we visit the nodes of a tree level by level. It can also be thought of as visiting nodes based off of their distance to the root.

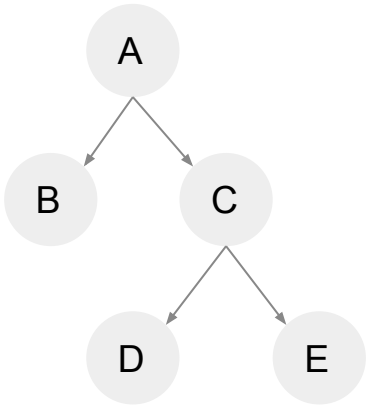
BFS is usually done using a queue.



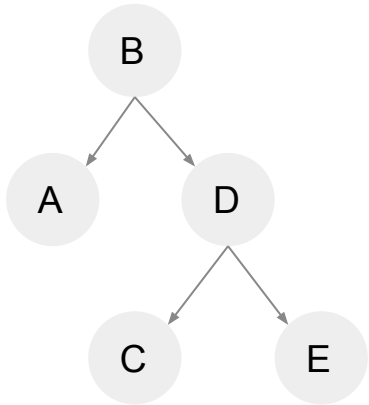
Depth First Search

Depth First Search means we visit each subtree in some order recursively.

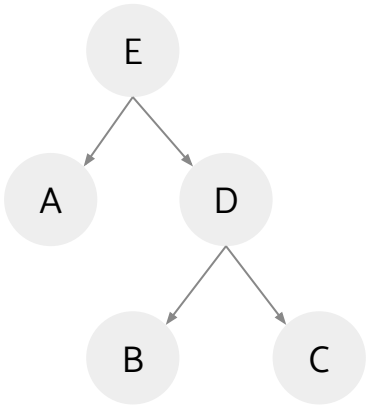
DFS is usually done using a stack.



Pre-order traversals visit the parent node before visiting child nodes.



In-order traversals visit the left child, then the parent, then the right child.

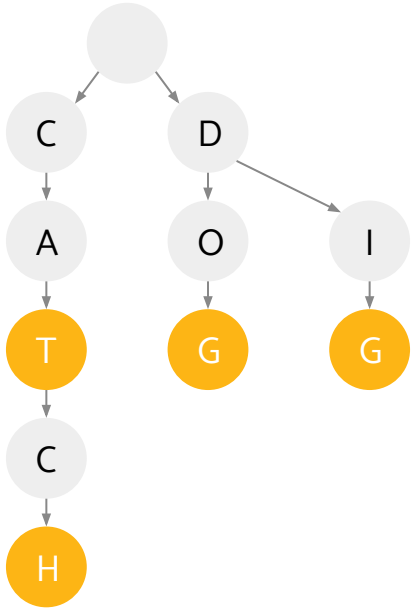


Post-order traversals visit the child nodes before visiting the parent nodes

Tries

Tries are special trees mostly used for language tasks.

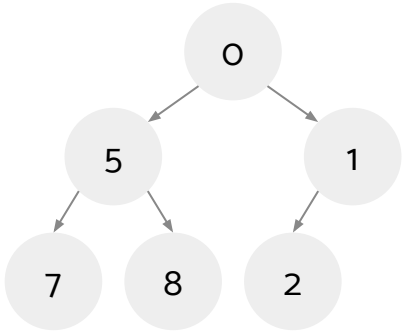
Each node in a trie is marked as being a word-end or not, so you can quickly check whether a word exists within your structure.



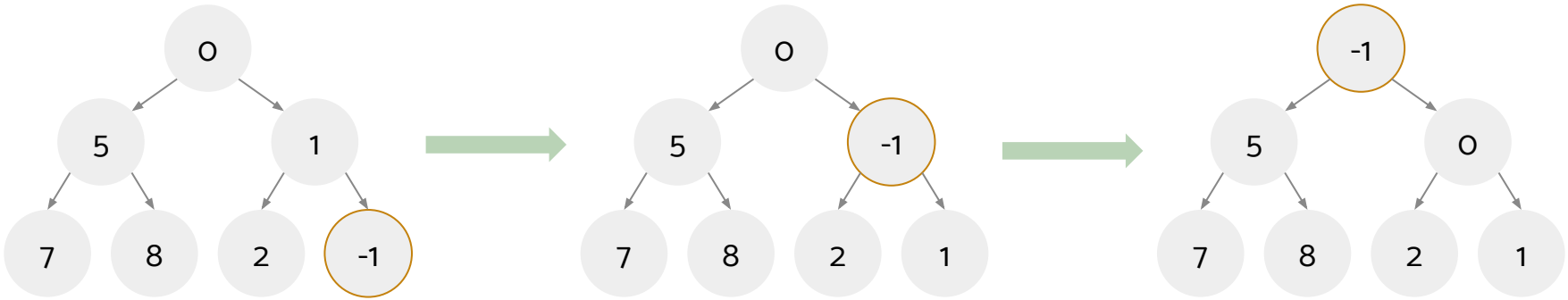
Heaps

Heaps are special trees that follow a few basic rules:

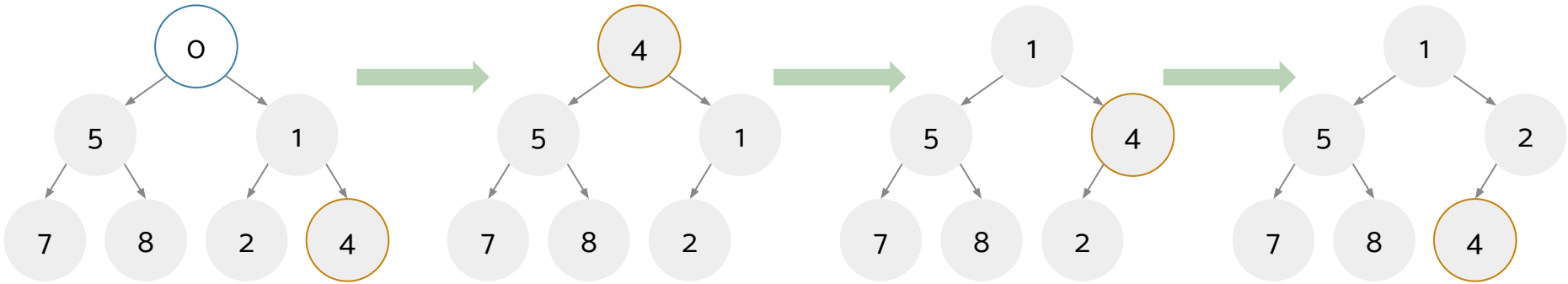
1. Heaps are complete - the only empty parts of a heap are in the bottom row, to the right
2. In a min-heap, each node must be *smaller* than all of its child nodes. The opposite is true for max-heaps.



Insertion into Heaps



Deletion from Heaps



Worksheet

1 Fill In The Blank

1. `removeMin` has a best case runtime of _____ and a worst case runtime of _____.
2. `insert` has a best case runtime of _____ and a worst case runtime of _____.
3. A _____ or _____ traversal on a min-heap can output the elements in sorted order.
4. The fourth smallest element in a min-heap with 1000 distinct elements can appear in _____ places in the heap.
5. Given a min-heap with 2n – 1 distinct elements, for an element . . .
    a. to be on the second level it must be less than _____ element(s) and greater than _____ element(s).
    b. to be on the bottommost level it must be less than _____ element(s) and greater than _____ element(s).

2 Heap Mystery

[A, B, C, D, E, F, G] -> [A, E, B, D, X, F, G]

Operations to reach this heap:

1. removeMin()
2. _____
3. _____
4. _____

X _____ D

X _____ C

B _____ C

G _____ X

3 A Wordsearch