LEAP@CMU 2016

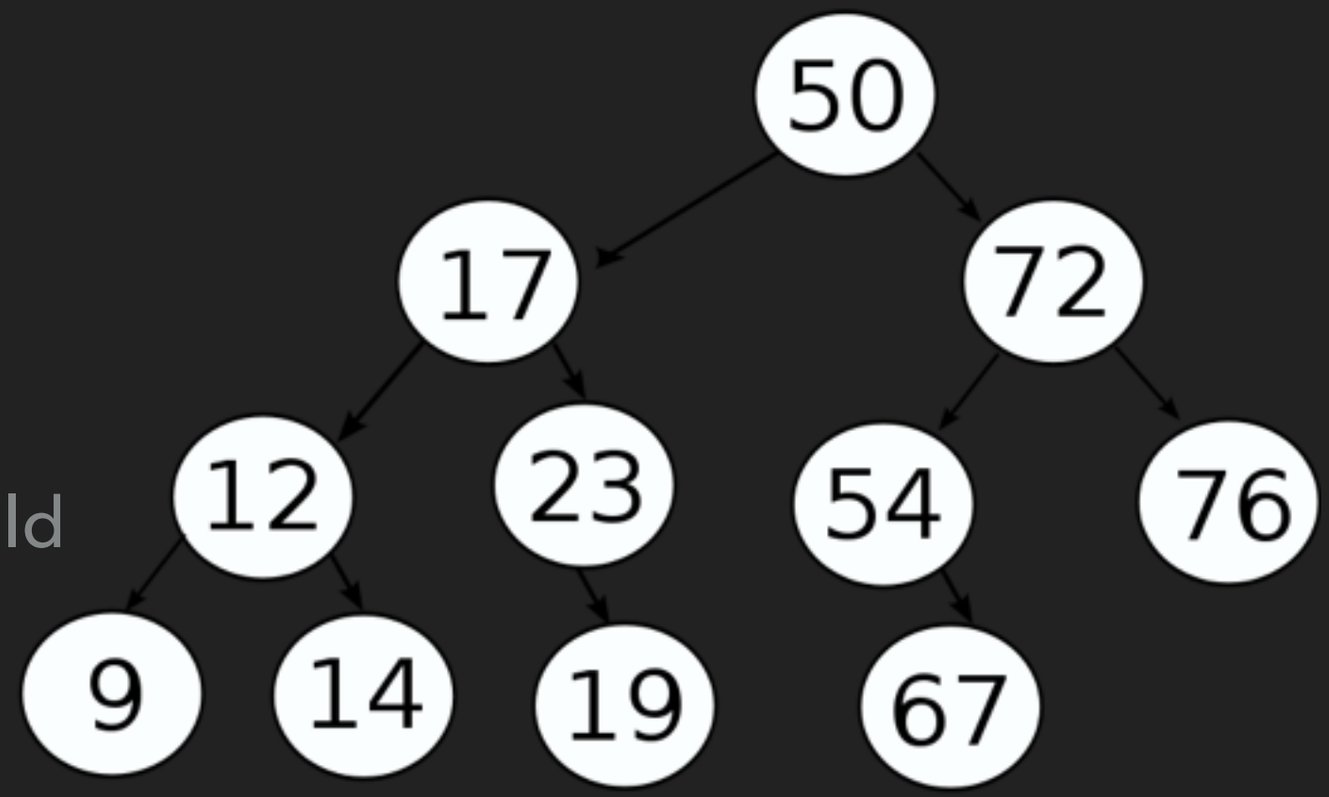
TREES AND HEAPS

“A TREE IS A DATA STRUCTURE MADE UP OF NODES OR VERTICES AND EDGES.”

Wikipedia

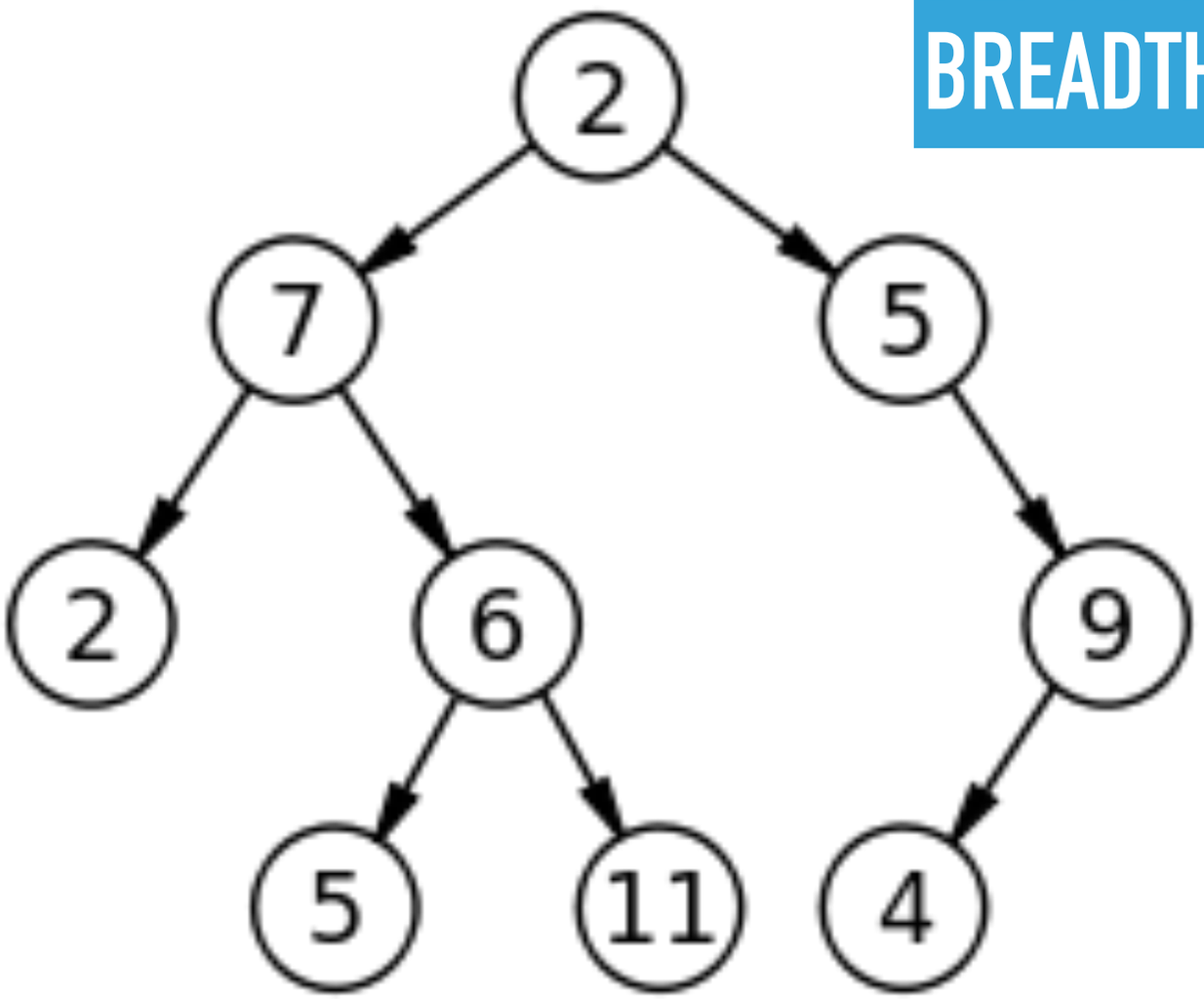
TERMINOLOGY

- Points that contain values are called **nodes**
- The arrow connecting nodes is called an **edge**
- A **parent node** connects to a child node with an edge
- The top node is called the **root**
- The **depth** of a node is its distance from the root in edges



TRAVERSING A TREE

- Traversing a tree means listing a tree in a logical way while hitting all of its nodes.
- **Depth-first traversing** means you list down the tree, hitting the deepest nodes before going across.
- **Breadth-first traversing** means you list layer-by-layer, moving down a layer after the right-most layer is hit.

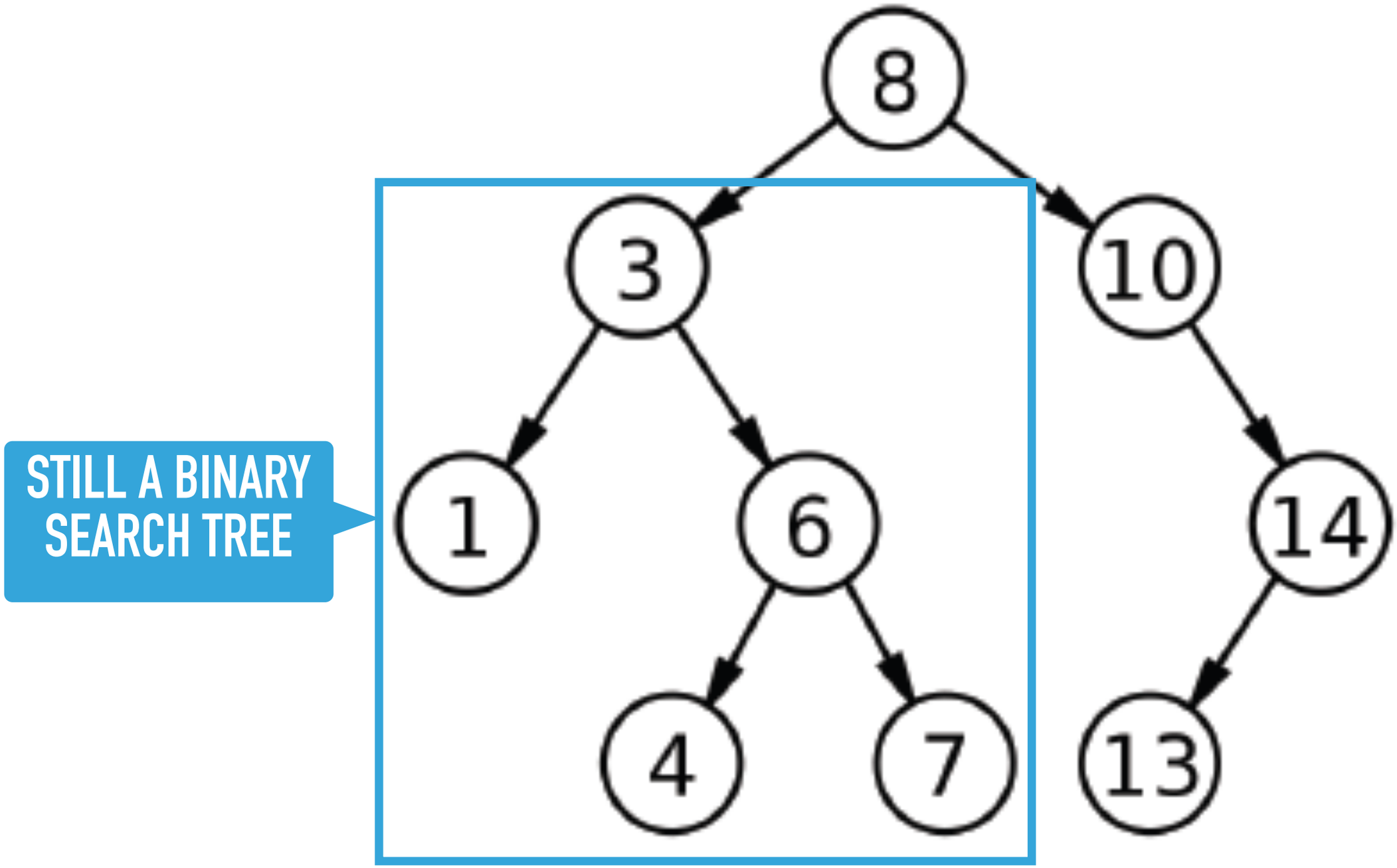


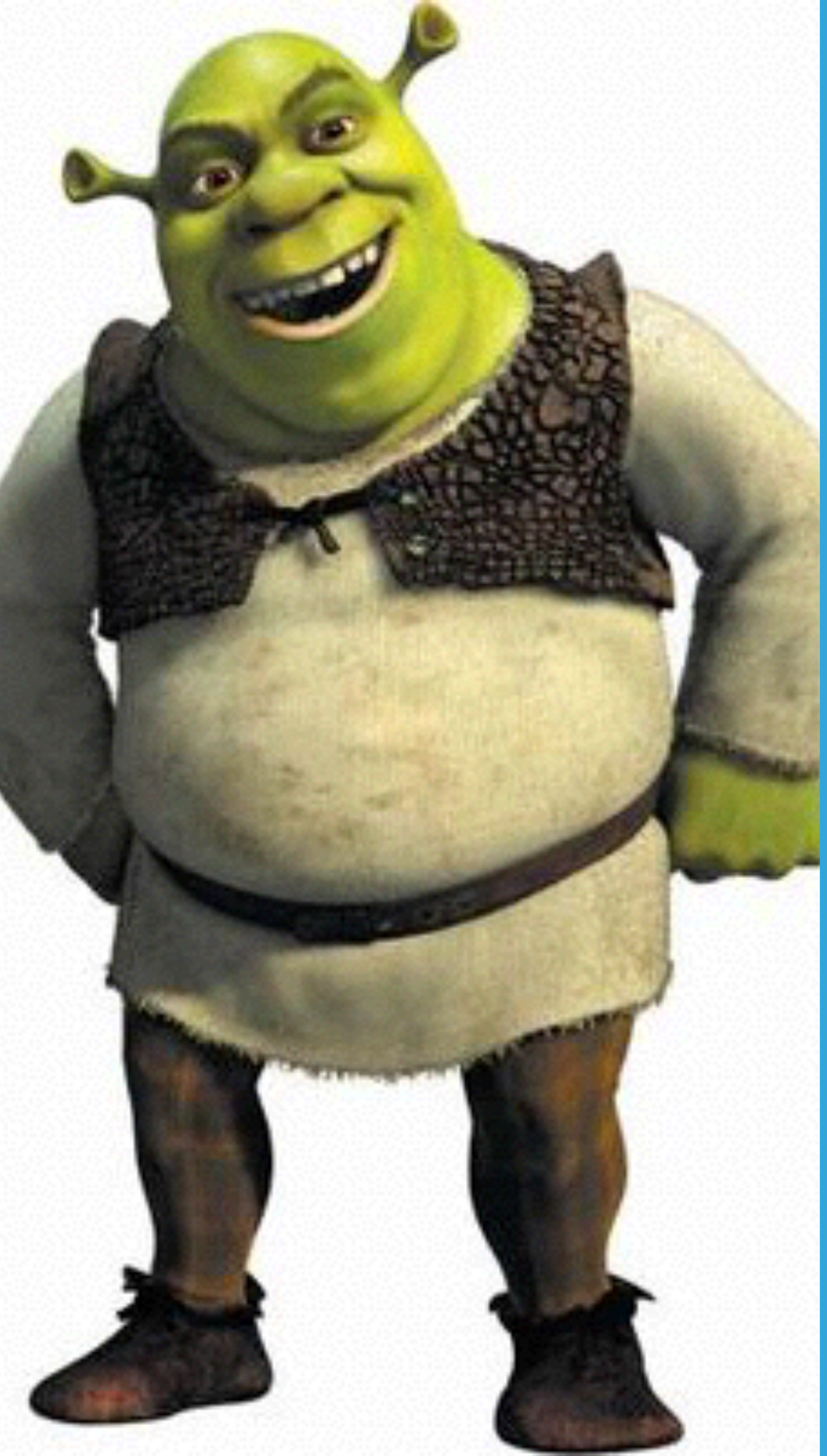
DEPTH-FIRST: 2, 7, 2, 6, 5, 11, 5, 9, 4
BREADTH-FIRST: 2, 7, 5, 2, 6, 9, 5, 11, 4

A BINARY SEARCH TREE IS A SPECIAL KIND OF TREE.

PROPERTIES

- Can only be created with comparable data (you can put them in order)
- Each parent node can only have up to 2 child nodes (one to the right and one to the left)
- Every node to the right must be greater than the parent node
- Every node to the left must be less than the parent node
- For each child node, the “subtree” or section that is created if the child node was treated as the root is also a binary search tree

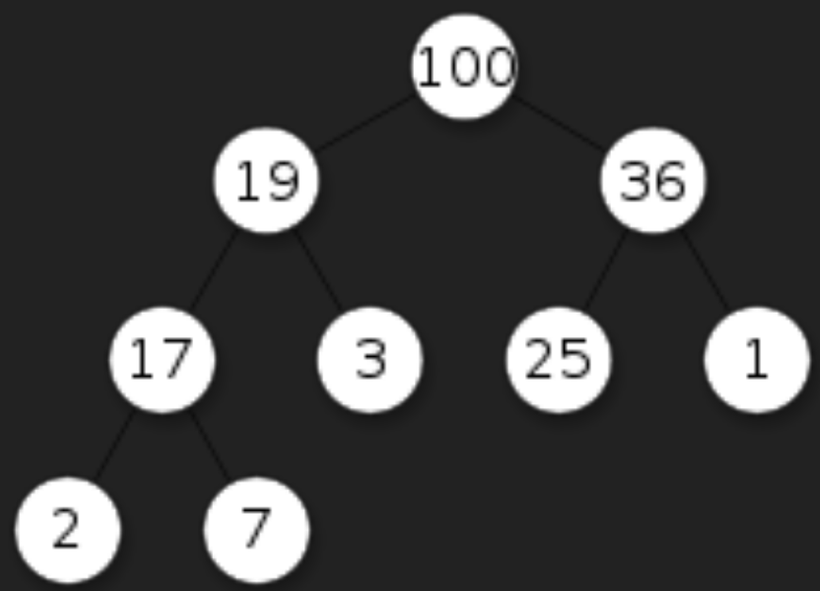

8
3
10
1
6
14
4
7
13
STILL A BINARY SEARCH TREE



JAVA REQUIRES YOU TO IMPLEMENT YOUR OWN TREES.

WHAT IS A HEAP?

Heaps are a specific type of tree where the top most node is always the most extreme (largest or smallest) and each child node is always less extreme (smaller in the first case, and larger in the second) than the parent.



TREES IN JAVA

- Implement a tree class using connected nodes
- Create a binary search tree from an array of numbers
- Include methods for adding, searching, and deleting
- Check if a tree is a heap

STAR GUIDELINES

★Implement a working tree

★Binary search tree

★Add and search methods

★Delete method

★Check if a tree is a heap

★Pretty-print trees in console