

Heaps and the Highest Paid Actors

By Jason England

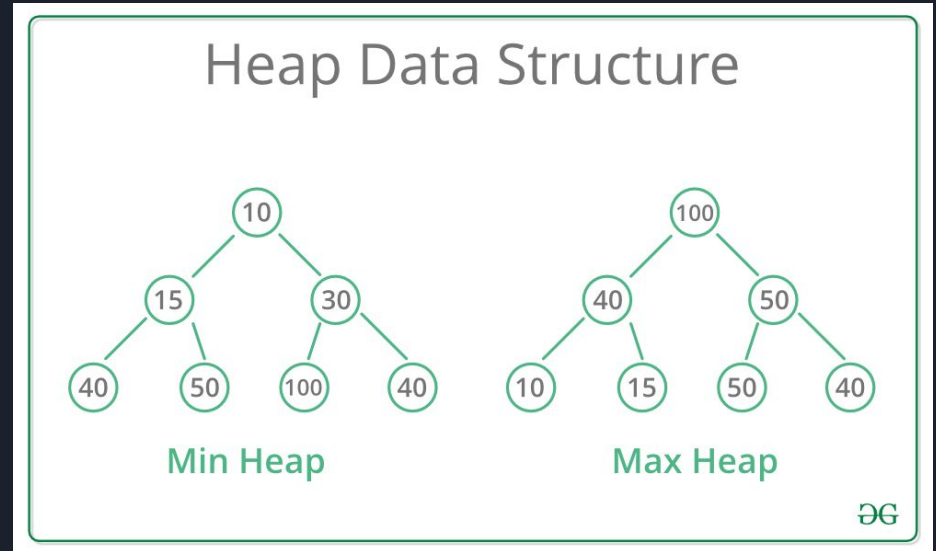


What is a Heap?

- Collection of Nodes
- Binary
- Node - Left, Right, key, value
- Either Min or Max

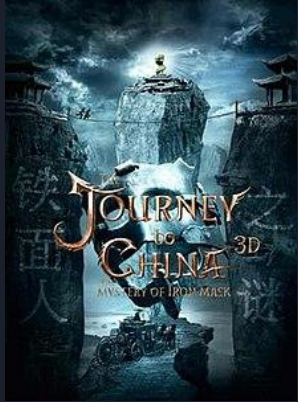
Min Heap vs. Max Heap

- Min Heap - lowest value is root
- Max Heap - Highest value is root



Jackie Chan

- 5th Highest Paid Actor in 2019
- \$58 Million
- Stars in:



The Climb



*The Knight of
Shadows: Between
Yin and Yang*





Heap vs. BST

Heaps

- Always add left to right
- Full/complete trees
- Always $O(\log n)$

BST

- Can be either left or right
- Not always a full/complete tree
- Can be $O(n)$ in worst case

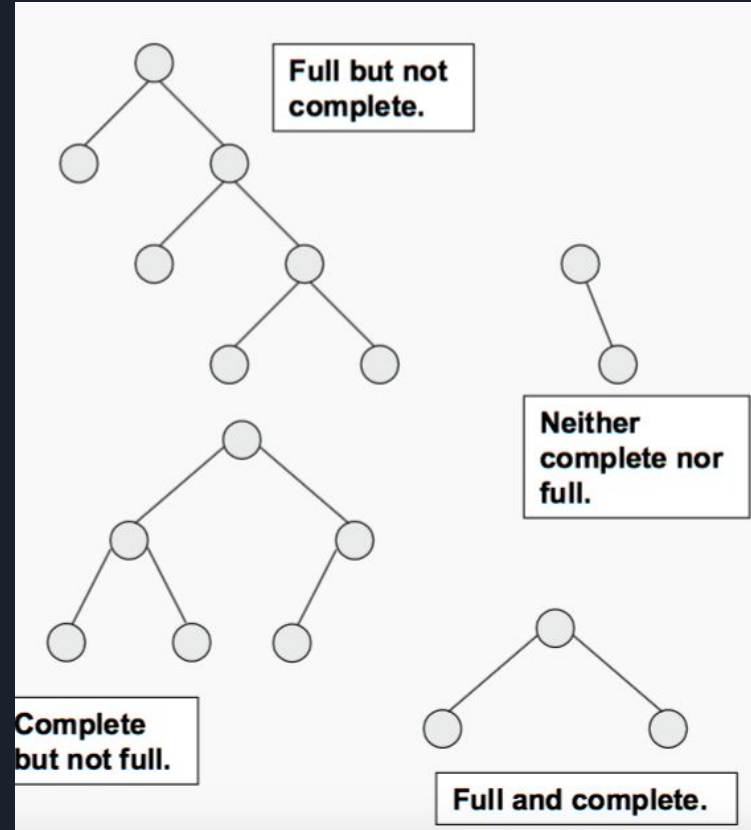
Full vs Complete Binary Tree

Full Binary Tree

- Every node except leaves have two children

Complete Binary Tree

- Every level of nodes except for the last level have 2 children





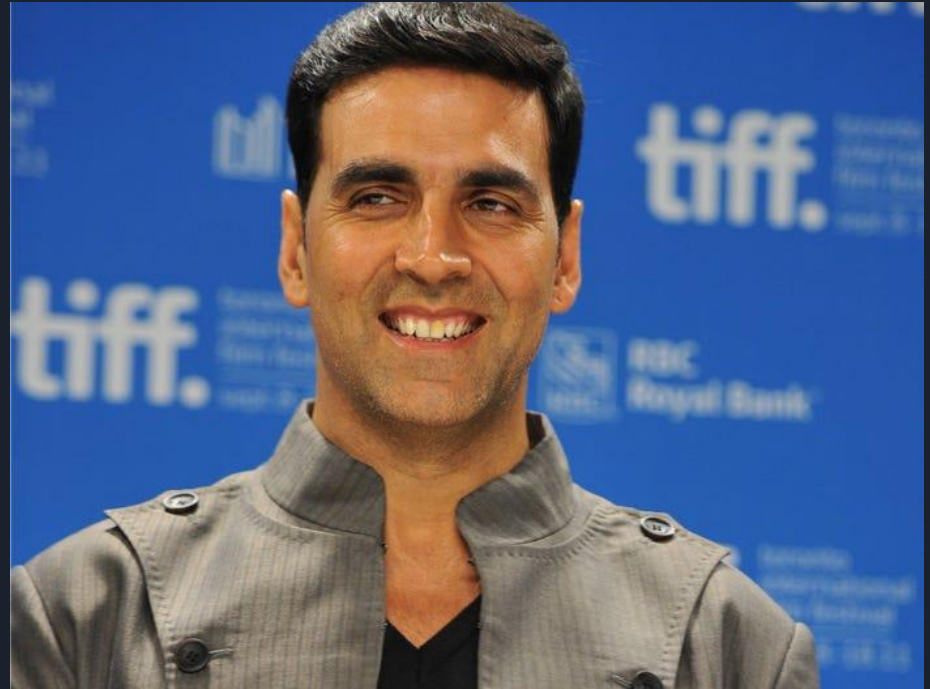
Performance

$O(\log n)$

- Insert is $O(\log n)$ -> tree depth is $\log n$
- `removeMin()` is $O(\log n)$ -> getting the min is $O(1)$ but you have to get the new root

Akshay Kumar

- 4th Highest Paid Actor in 2019
- \$65 Million
- Stars in:





Heap Commands

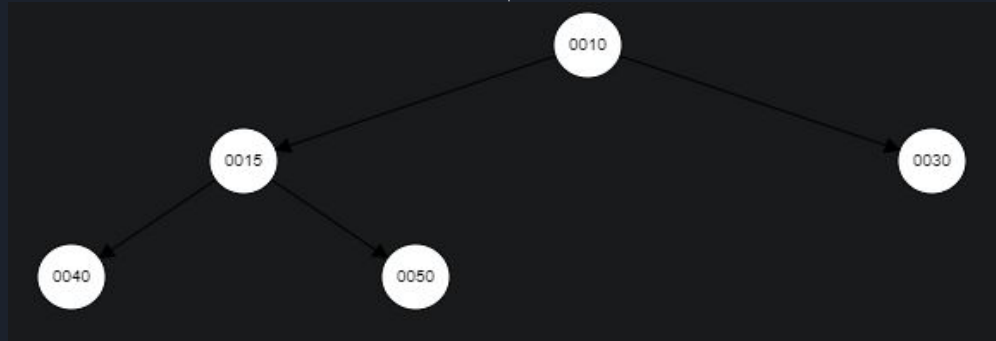
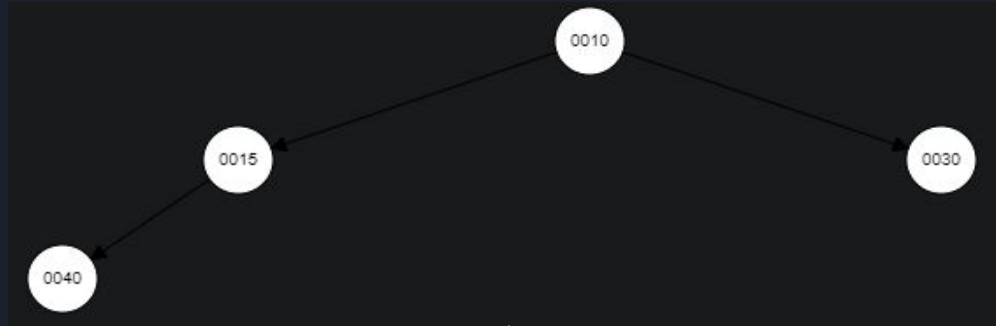
- `insert(item)`
- `removeMin()`
- `isEmpty()`



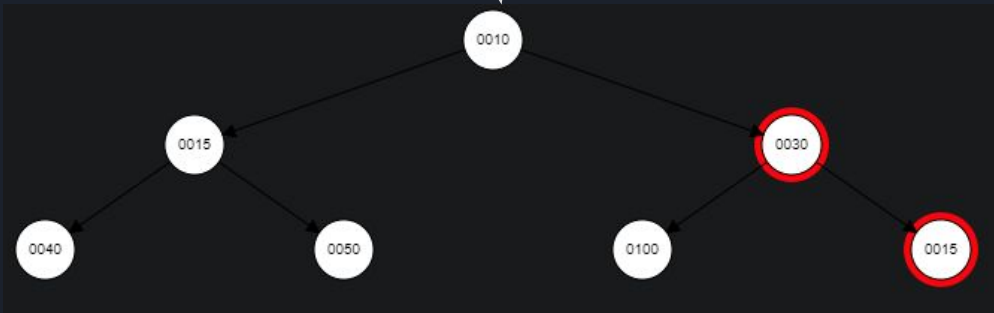
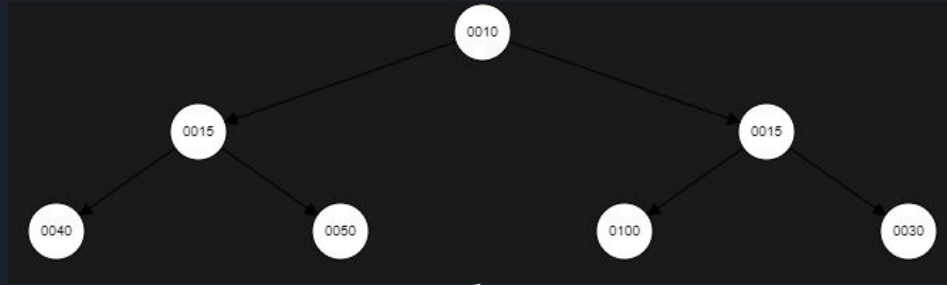
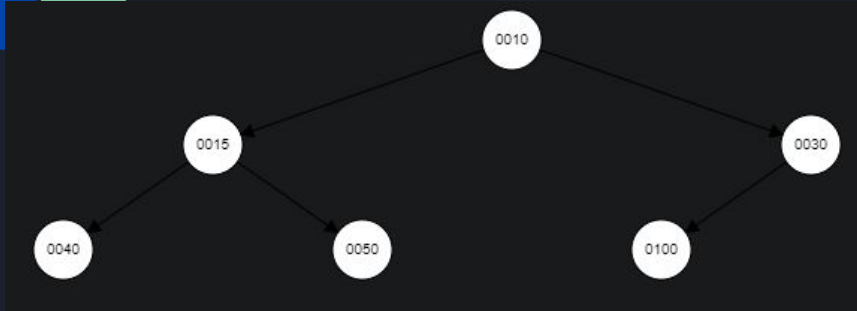
insert()

- Returns nothing
- Adds a new node at the end
- Swaps with parent if less than

insert() Example



insert() Example Cont.



Robert Downey Jr

- 3rd Highest Paid Actor in 2019
- \$66 Million
- Stars In:

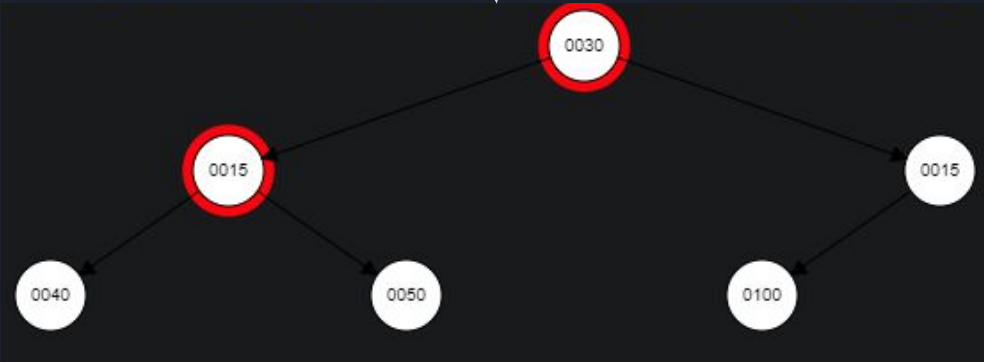
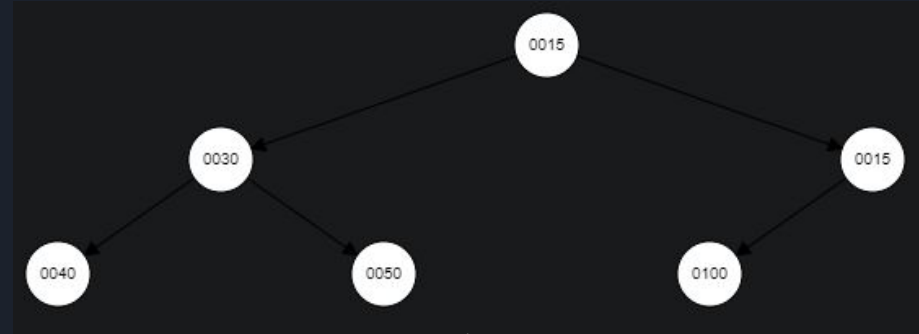
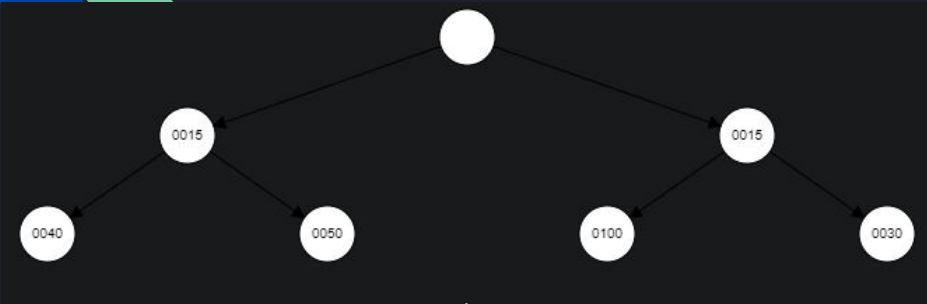




removeMin()

- Removes the smallest value
- Returns that node
- Makes the next smallest number the root

removeMin() Example



Chris Hemsworth

- 2nd Highest Paid Actor in 2019
- \$76.4 Million
- Stars In:



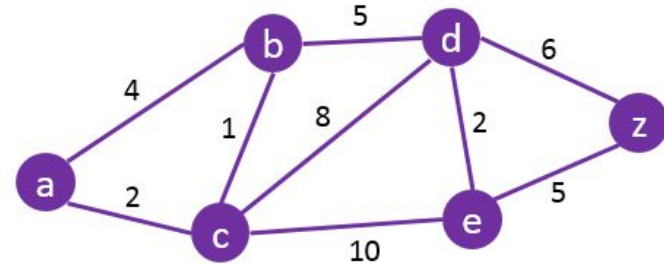


isEmpty()

- Checks if the Heap Tree is empty
- Returns true or false

Applications of Heaps

- Priority Queues
- Dijkstra's algorithm - finding the shortest path



Dijkstra's Algorithm

What is the shortest path to travel from A to Z?

Dwayne "The Rock" Johnson

- Highest Paid Actor in 2019
- \$89.4 Million
- Stars in:





Review

- Smallest value is the root
- Always full/complete tree
- $O(\log n)$ - Always