File Edit View Help

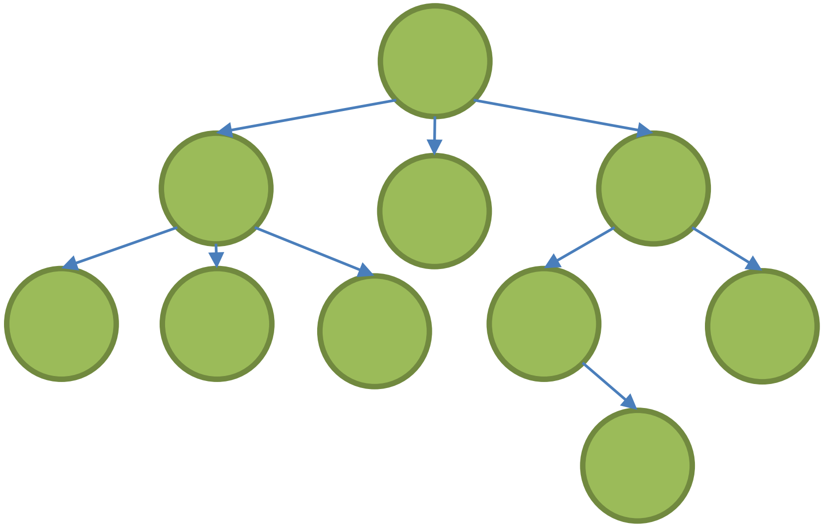
File Edit View Help

Heaps

Trees

- Definition: A data structure that can be defined recursively as a collection of nodes, where each node is a data structure consisting of a value, together with a list of references (edges) to nodes, with the constraints that no reference is duplicated, and none points to the root.

Trees



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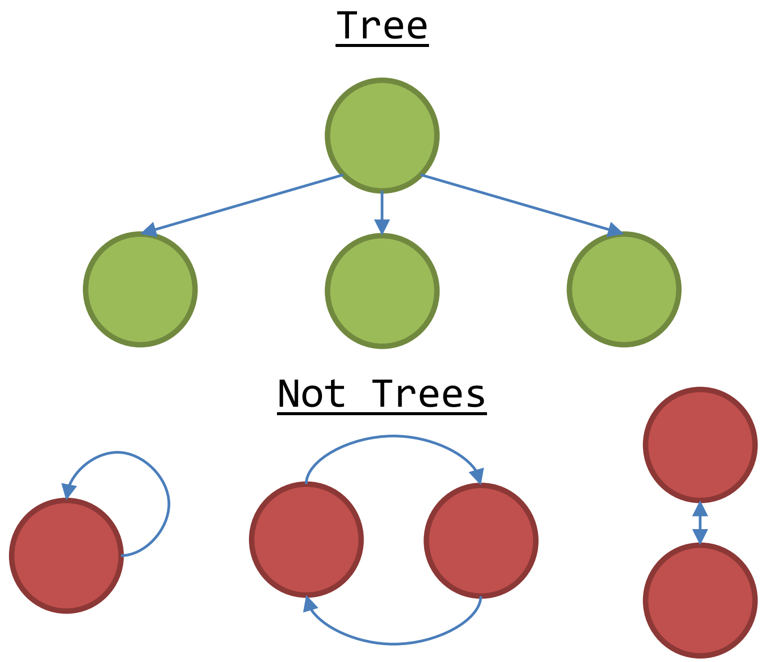
Trees

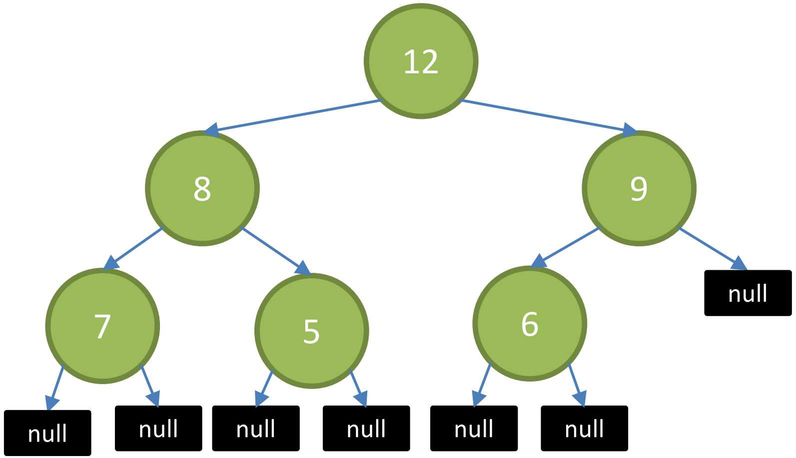
- Trees Have
  - Nodes
  - Edges
- Trees CANNOT
  - Contain Self-Referencing Edges
  - Have Cycles
  - Be Disjointed



Heaps

- Binary Tree Structure
- Node’s data must be comparable
- Node’s have at most two children
  - Left Child
  - Right Child
- Max Heap: Children must be less than or equal to the parent
- Min Heap: Children must be greater than or equal to the parent
- Assume Leaves are NULL references

Max Heap



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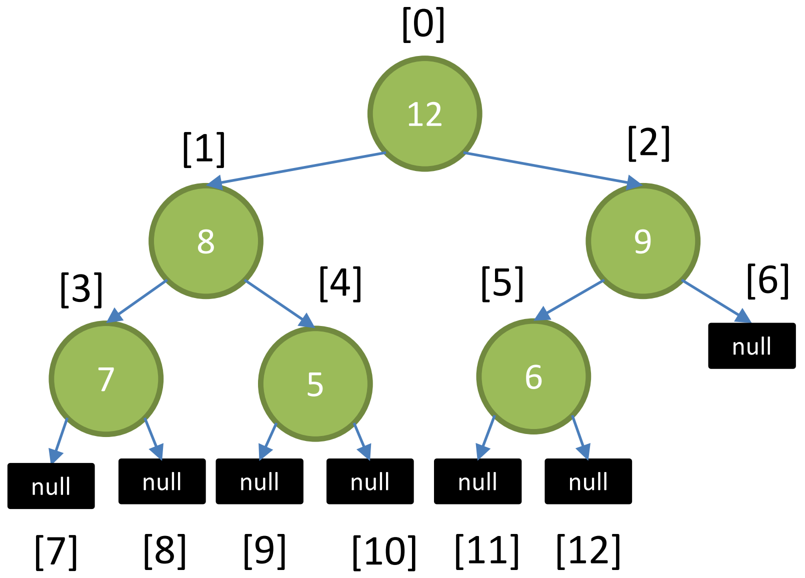
Heaps

- Array Heap
- Assume Root is at Index 0
- Left Child Index = Parent Index * 2 + 1
- Right Child Index = Parent Index * 2 + 2
- Parent Index = (Child Index-1)/2

Array Max Heap

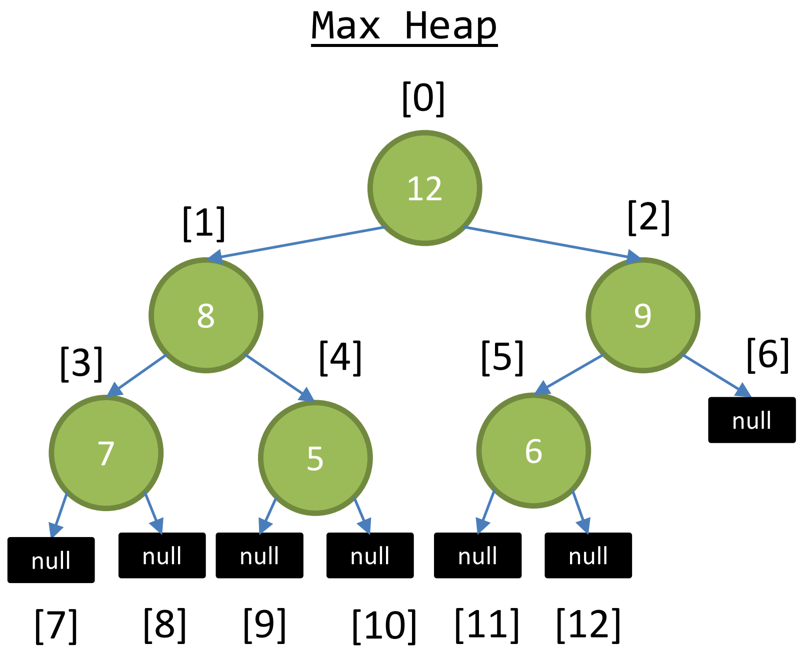
0	1	2	3	4	5	6	7	8	9	10	11	12
12	8	9	7	5	6	-	-	-	-	-	-	-

Max Heap



Heaps

- Add
  - Replace the first leaf in breadth order with the new data
  - From that node "bubble up" the data if necessary
- Bubble Up
  - If the child's data is larger than the parent then swap that information
  - Continue swapping child data with parent data until the parent is larger than the child or we reach the root index



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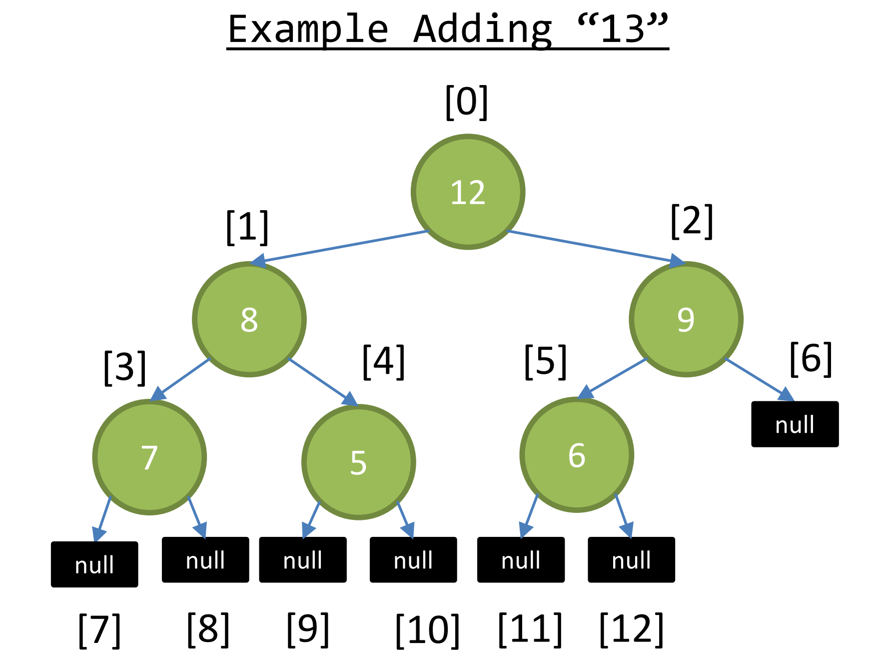

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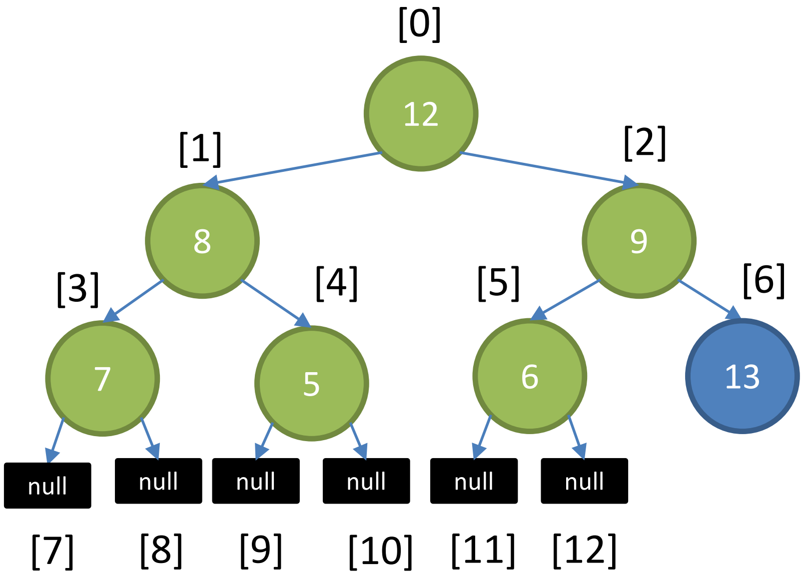
Example Adding “13”



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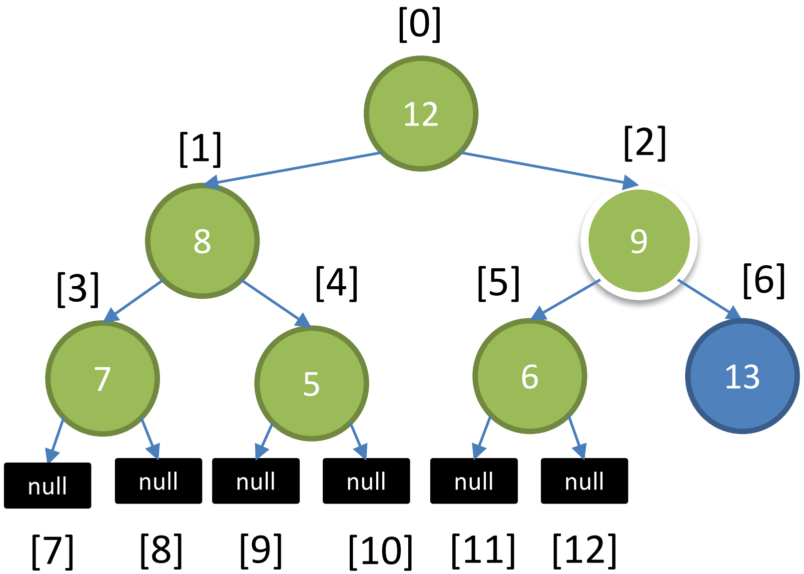

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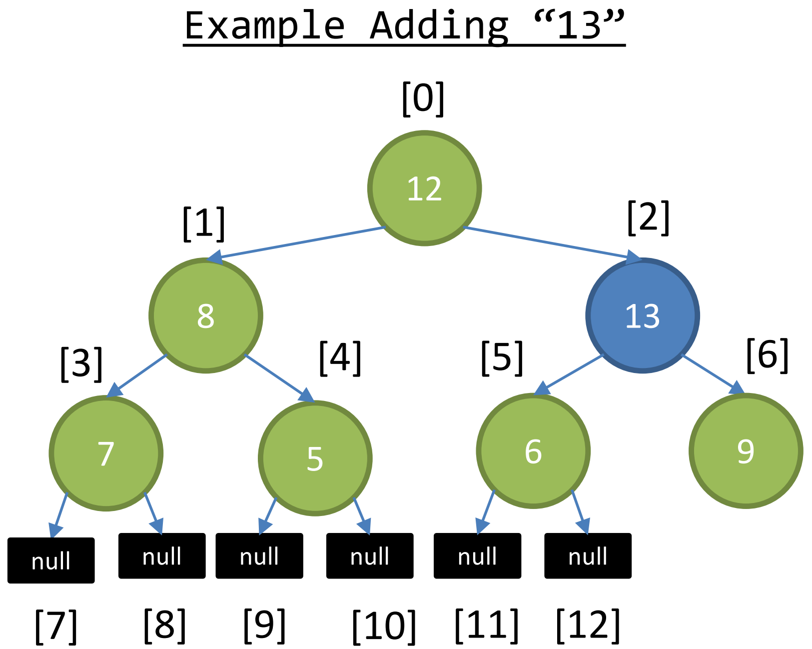

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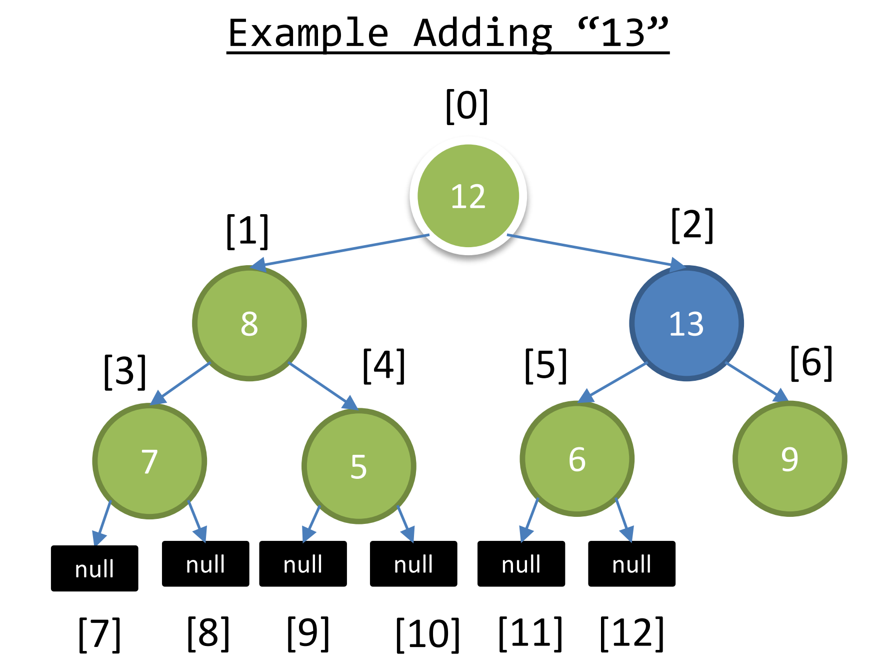

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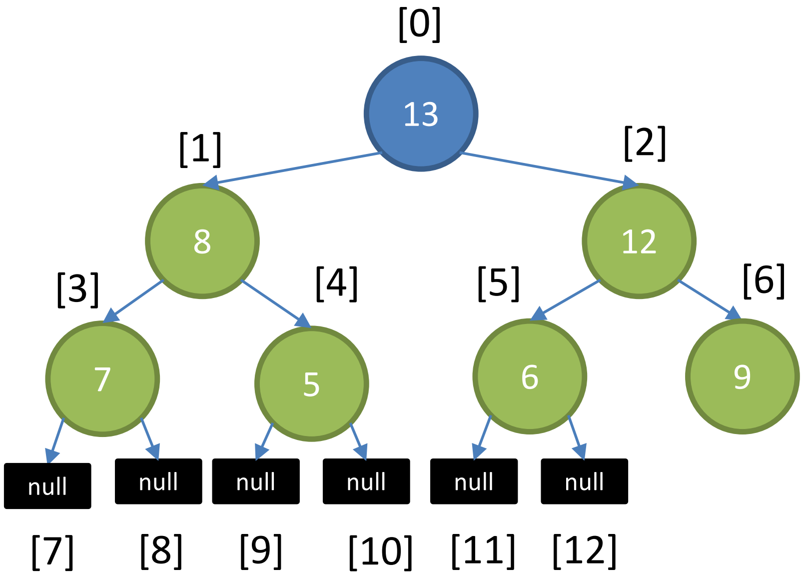

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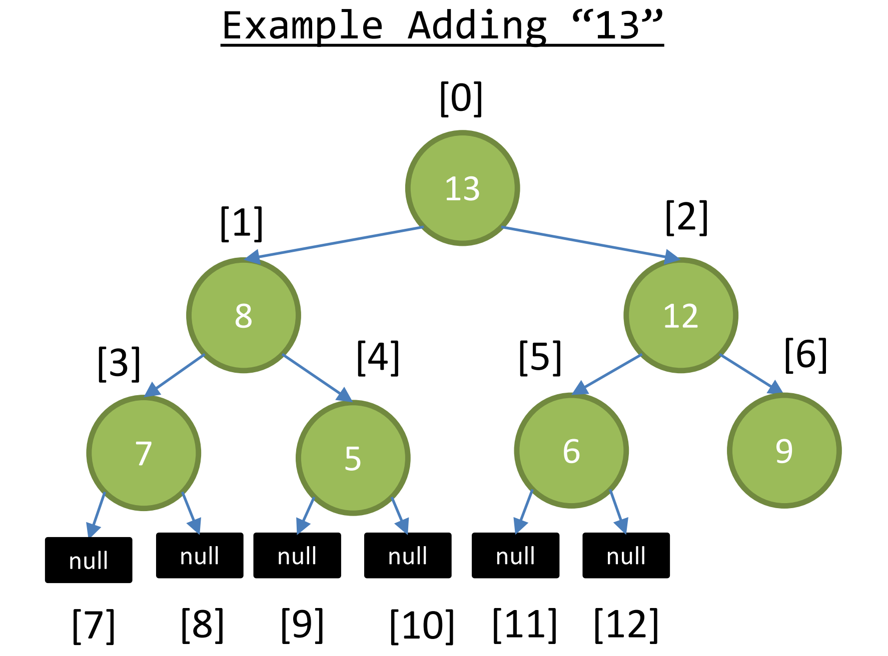

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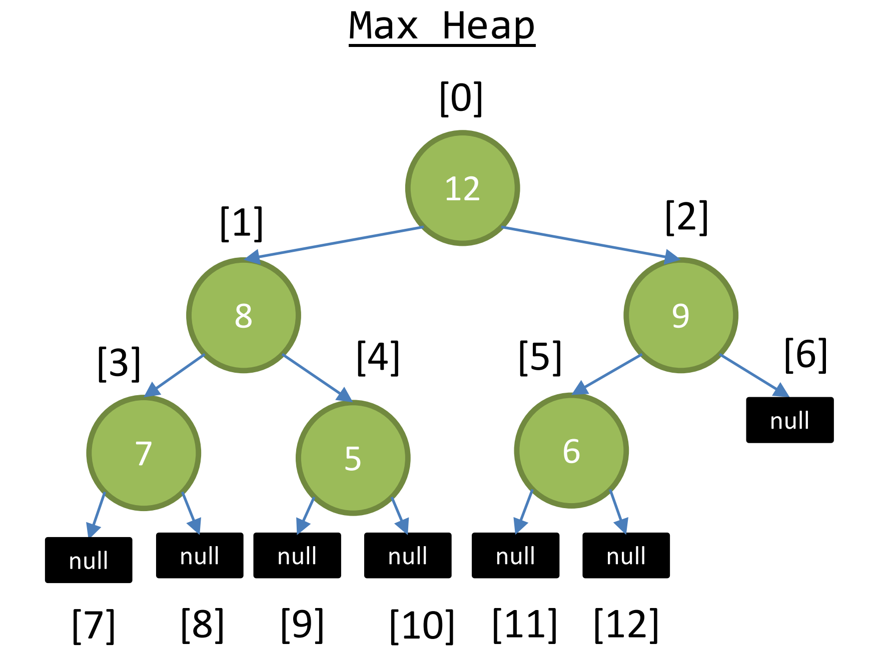

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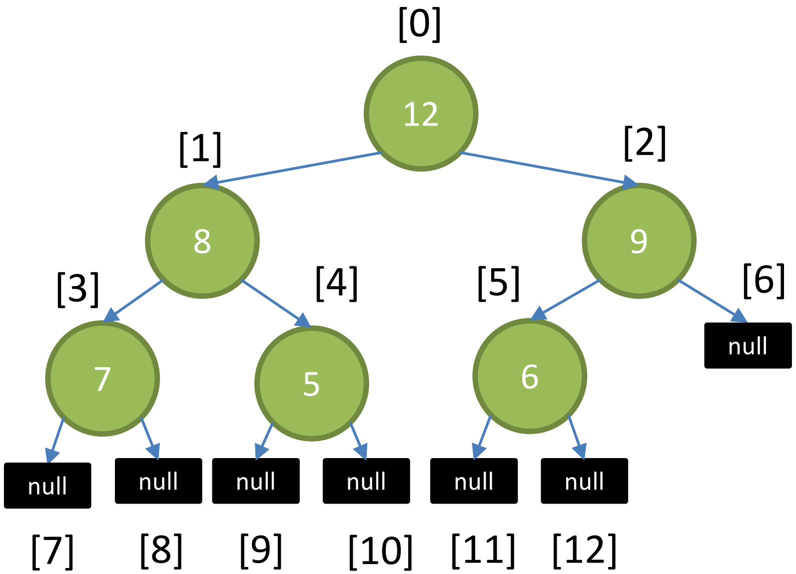

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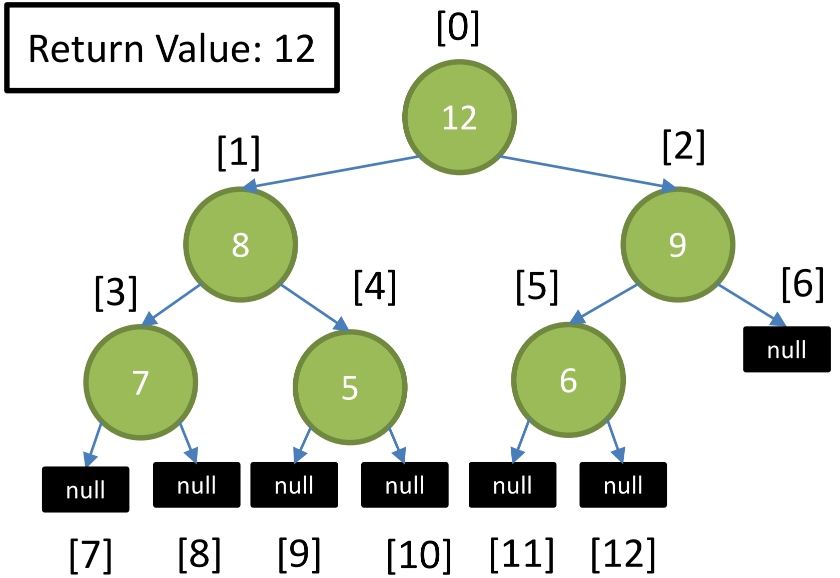

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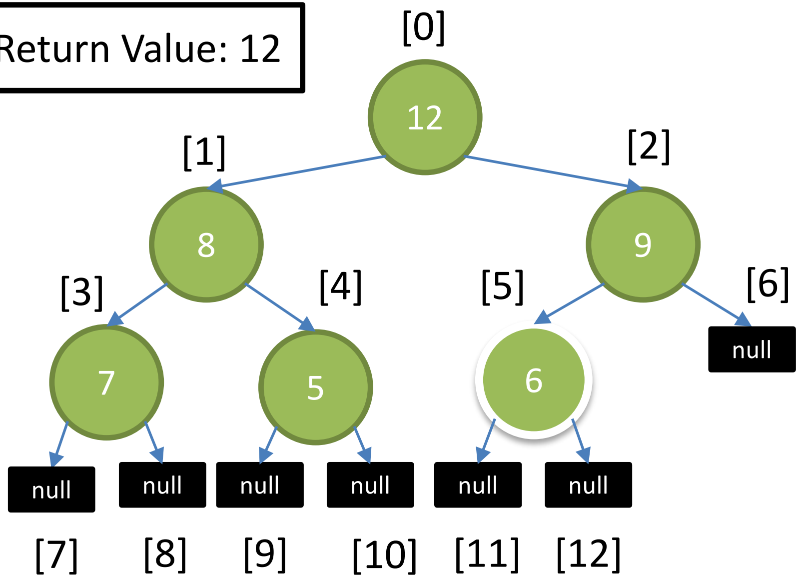
Example Remove

Return Value: 12



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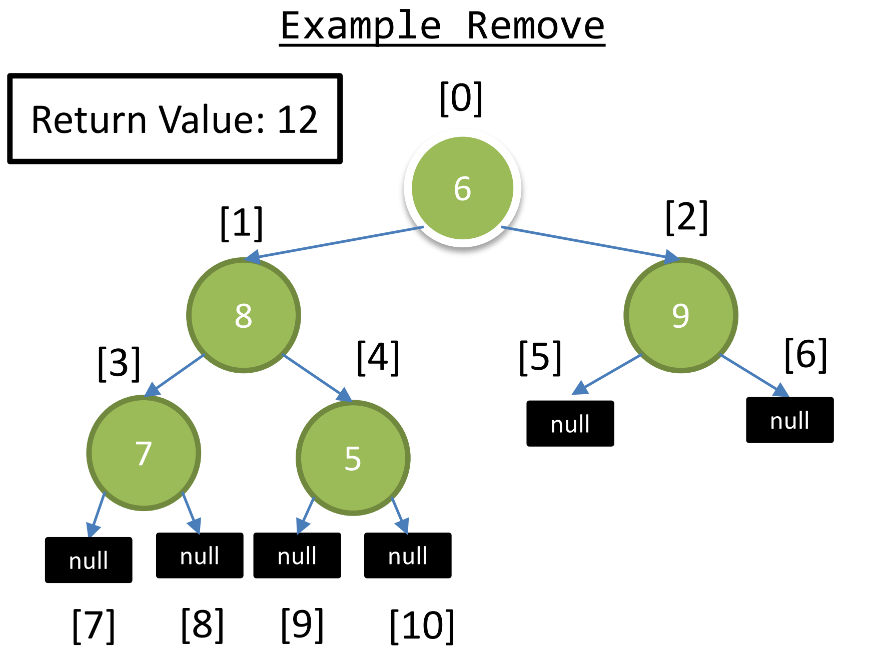

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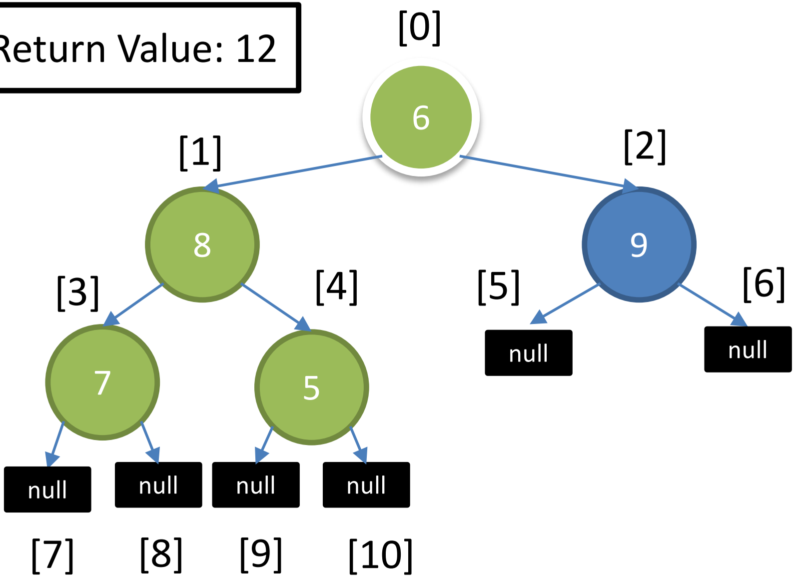

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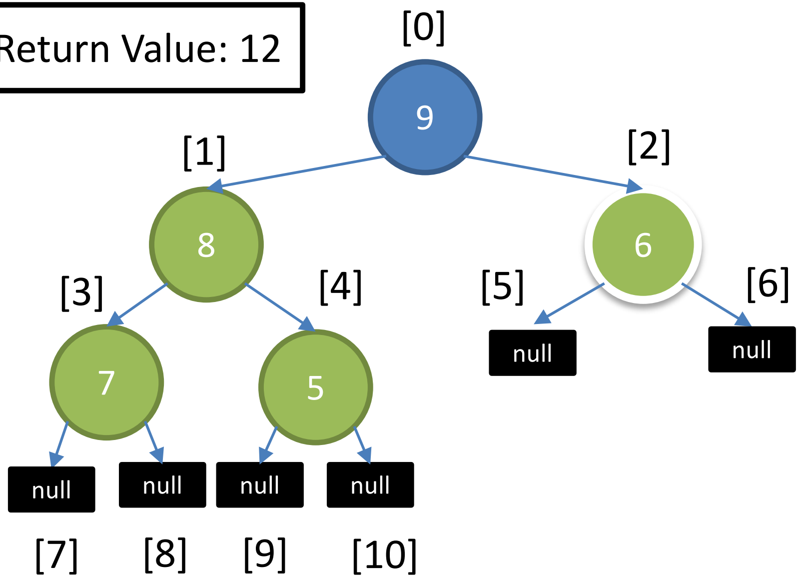

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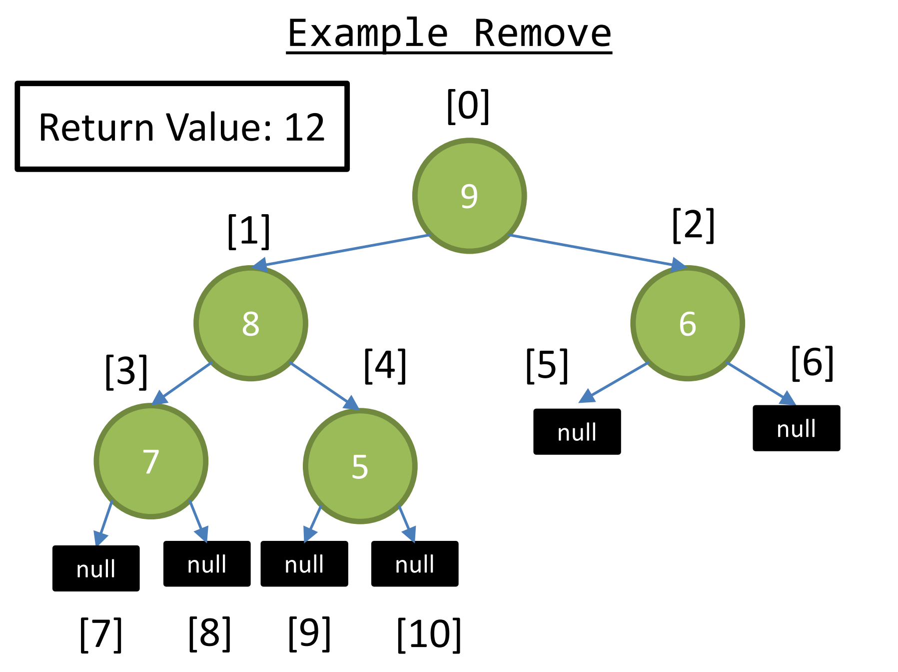

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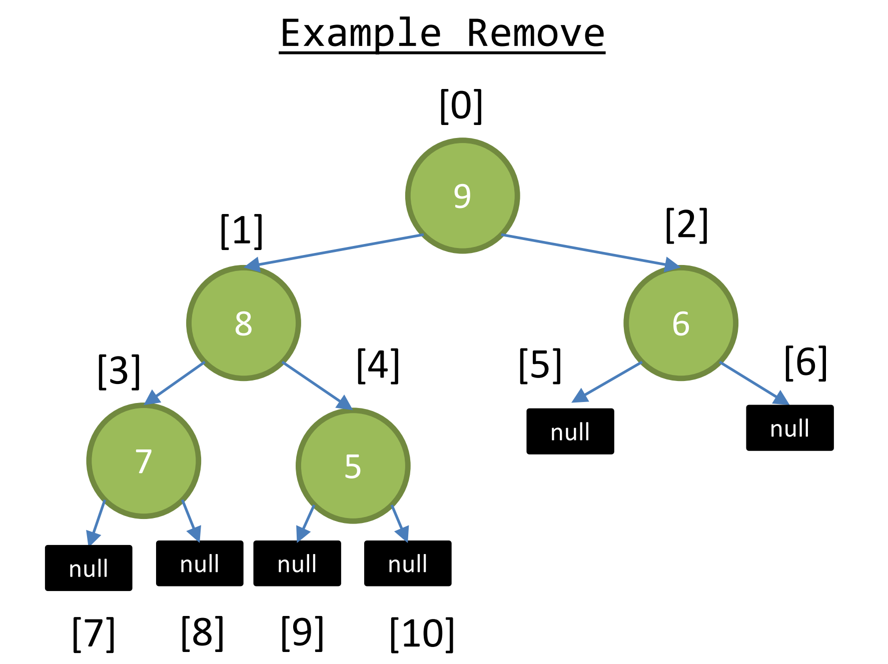

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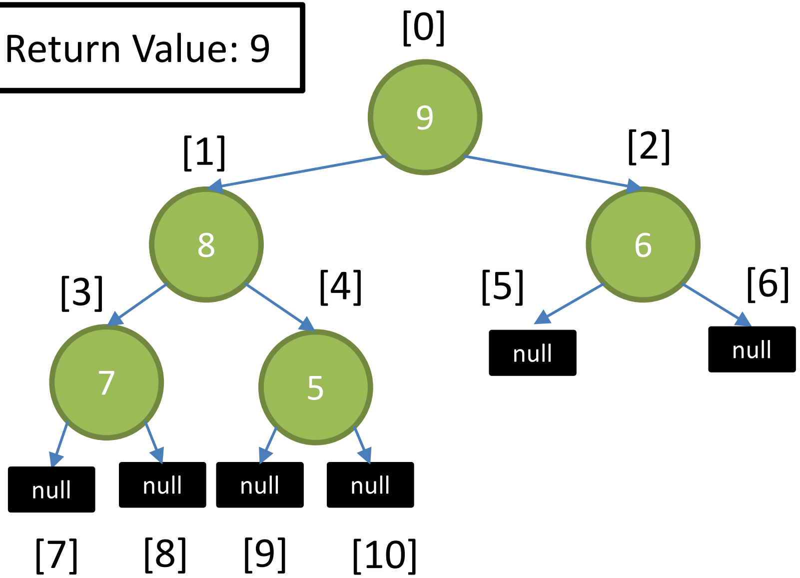
Example Remove Again

Return Value: 9



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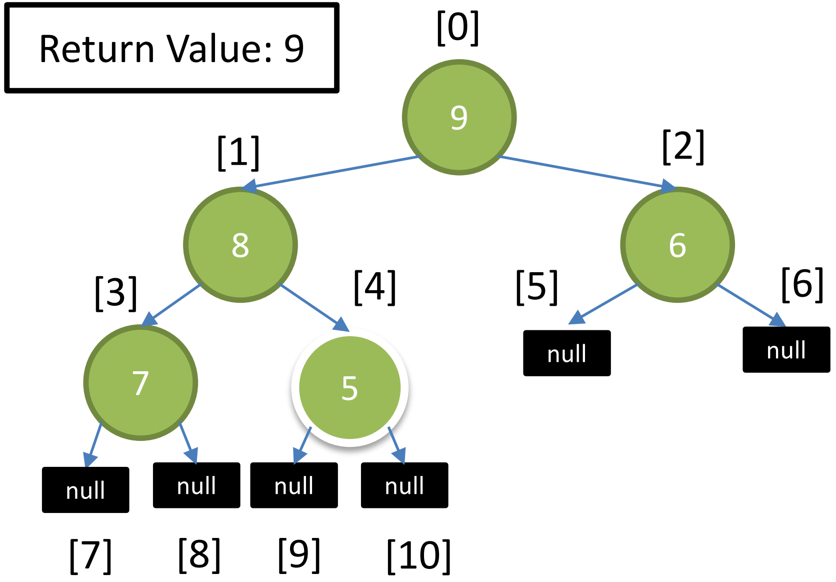

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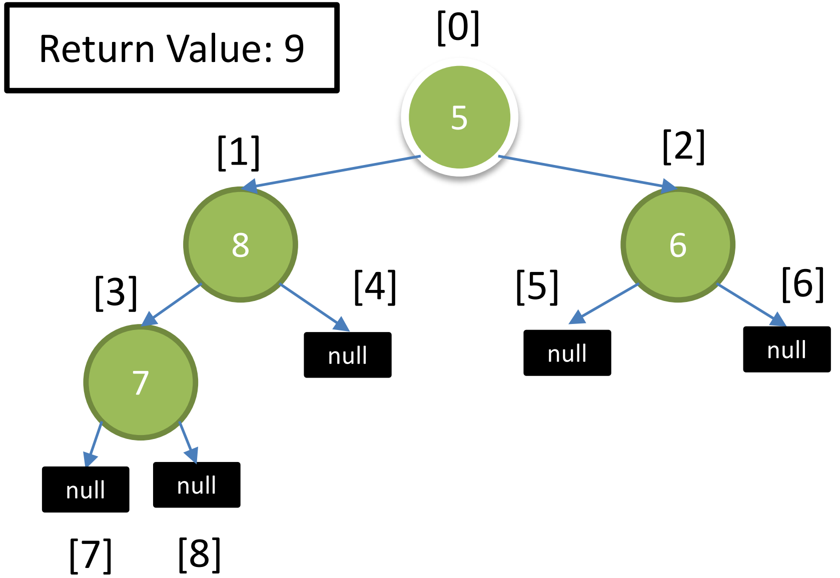

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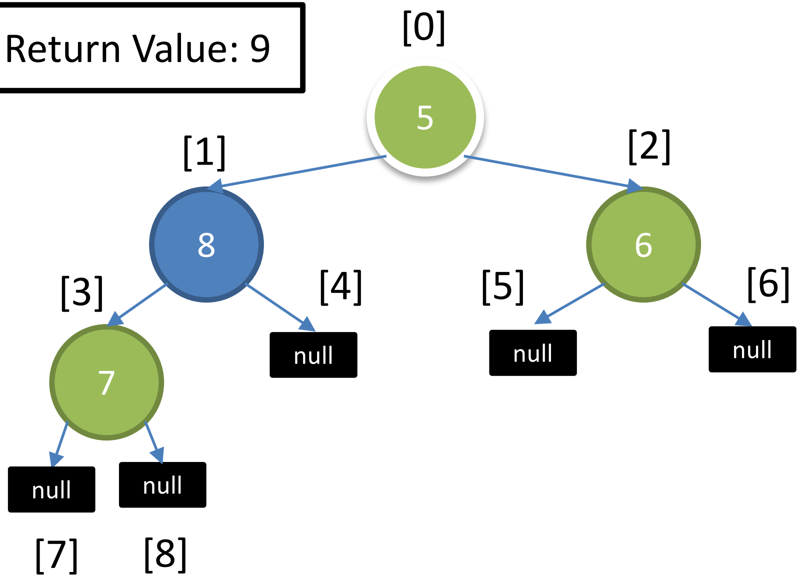

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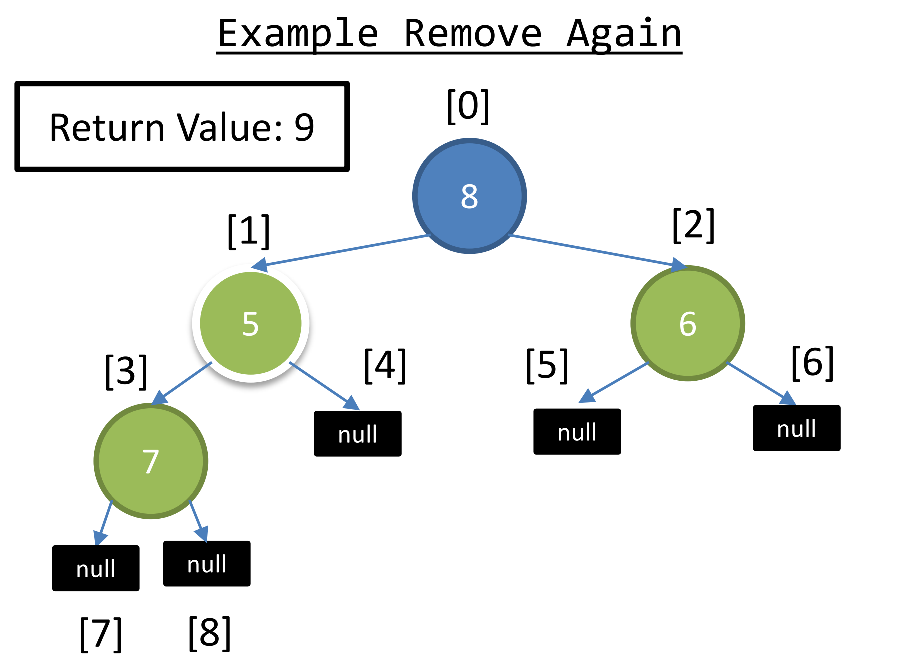

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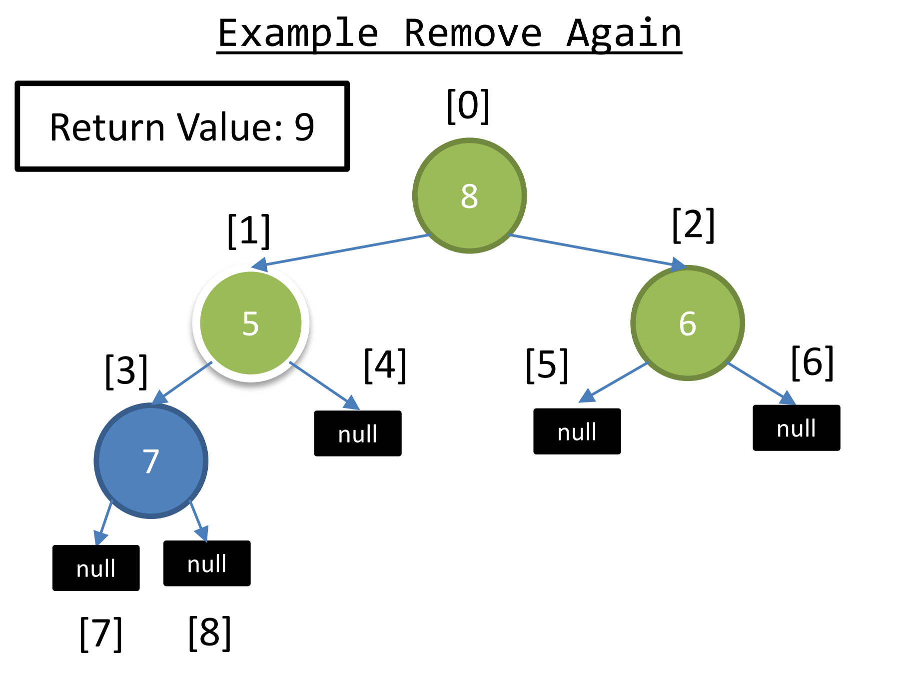

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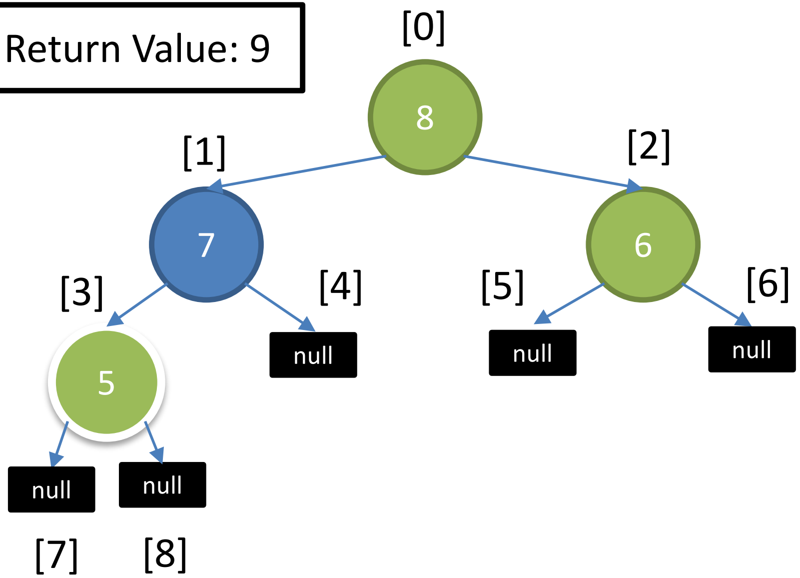

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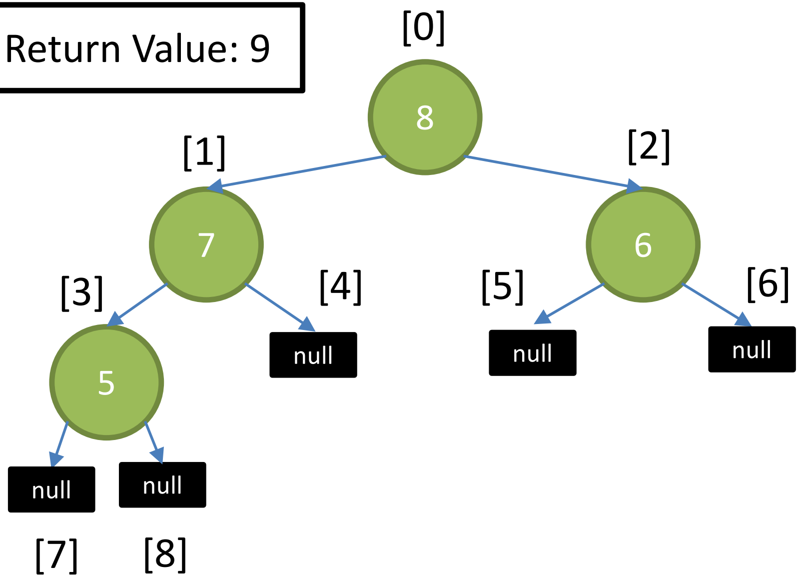

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