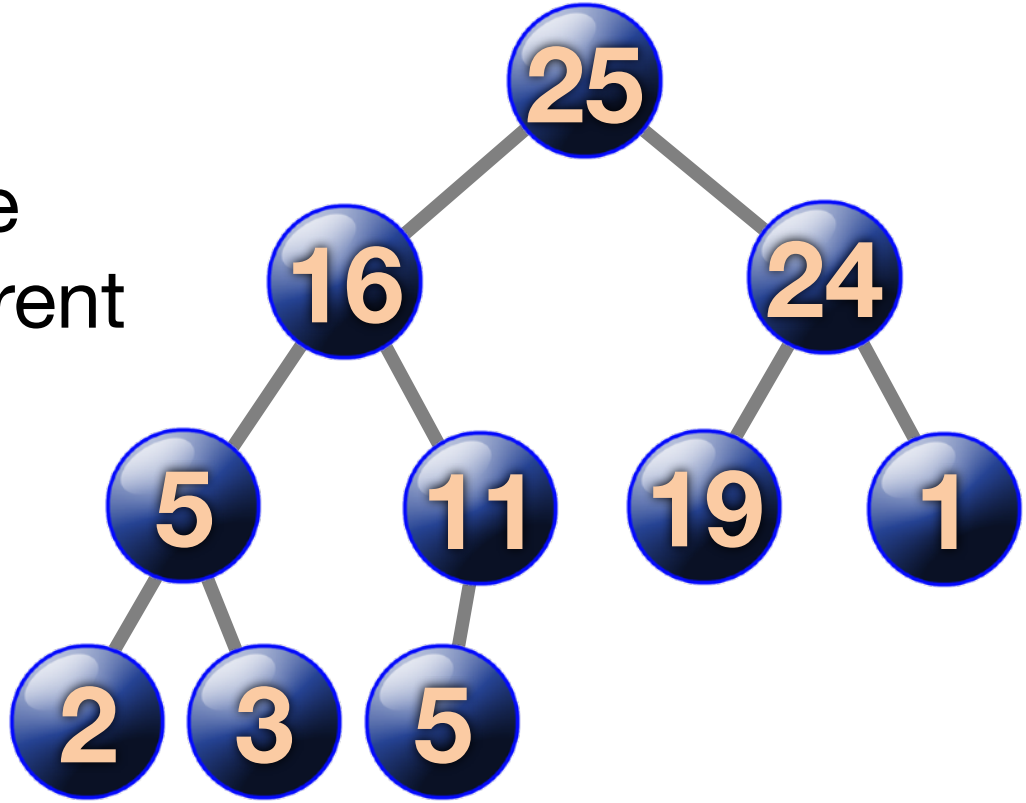
Python MaxHeap

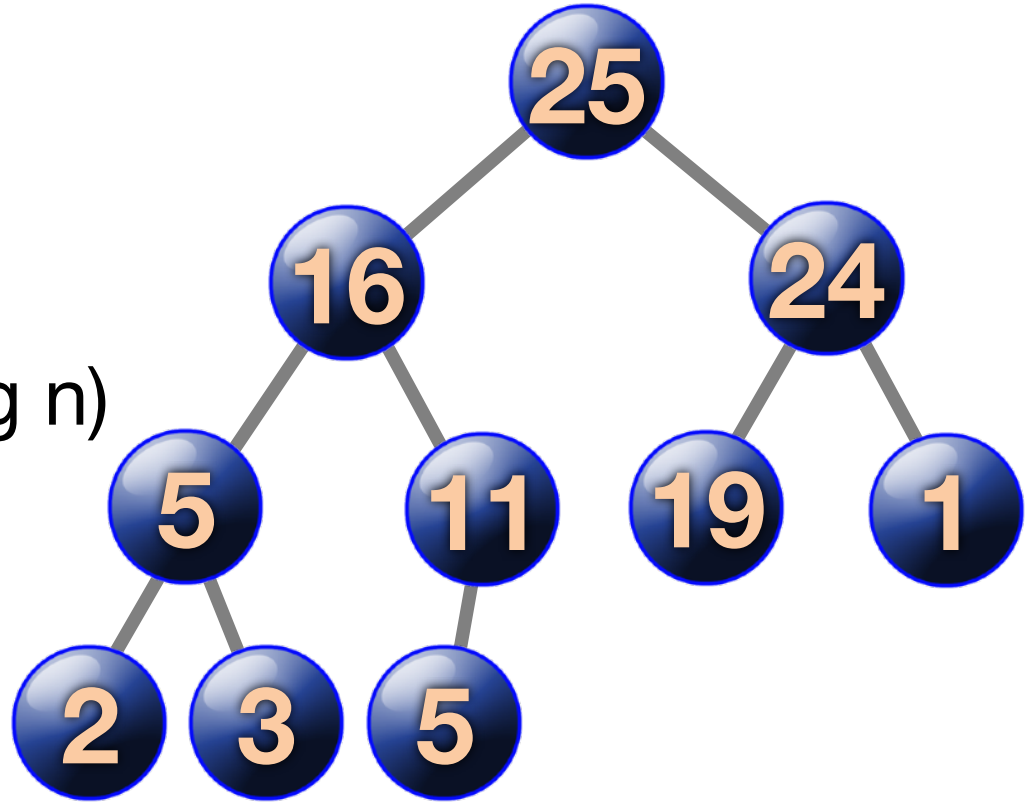
What is a MaxHeap?

- Complete Binary Tree
- Every node <= its parent

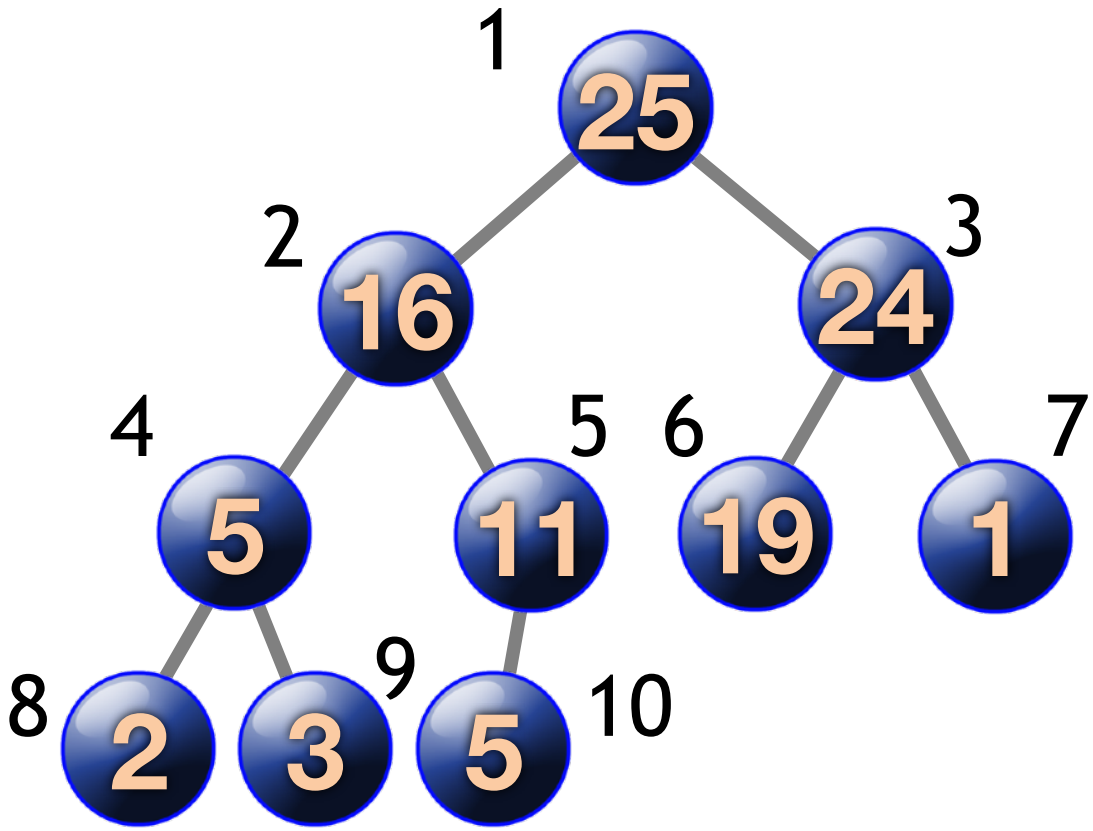


MaxHeap is FAST!

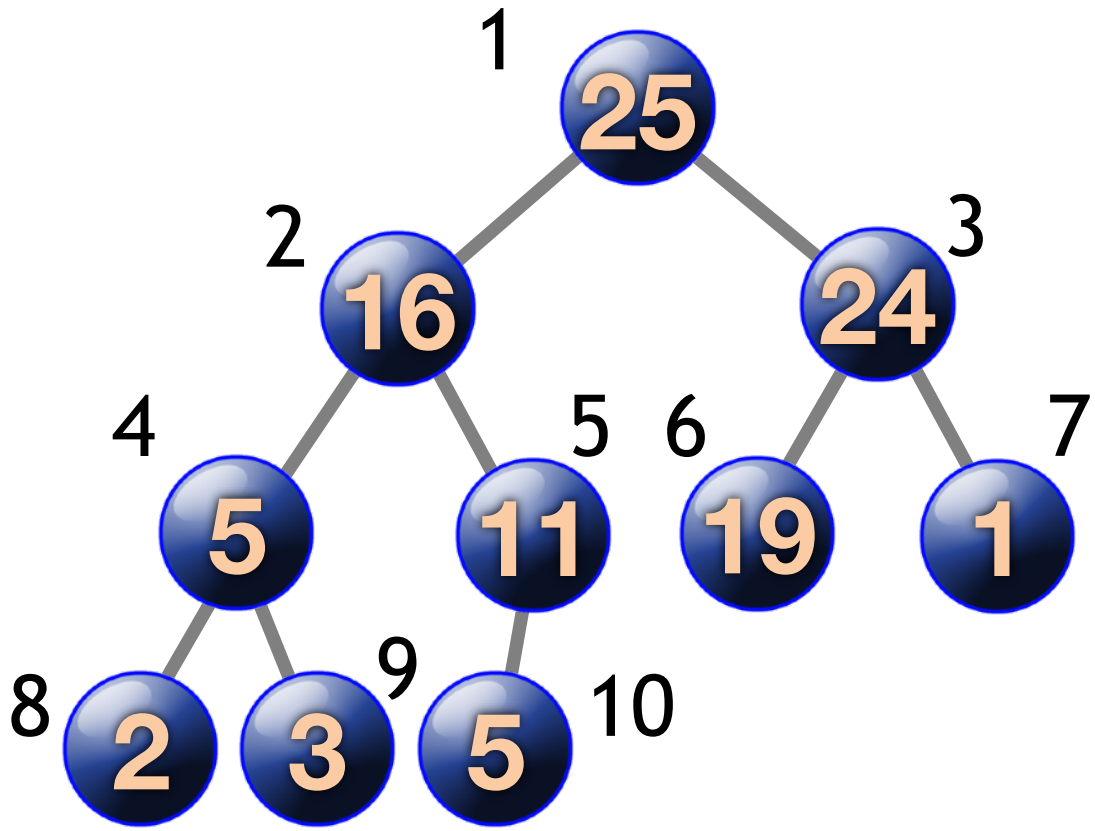
- Insert in O(log n)
- Get Max in O(1)
- Remove Max in O(log n)



Easy to implement using a List



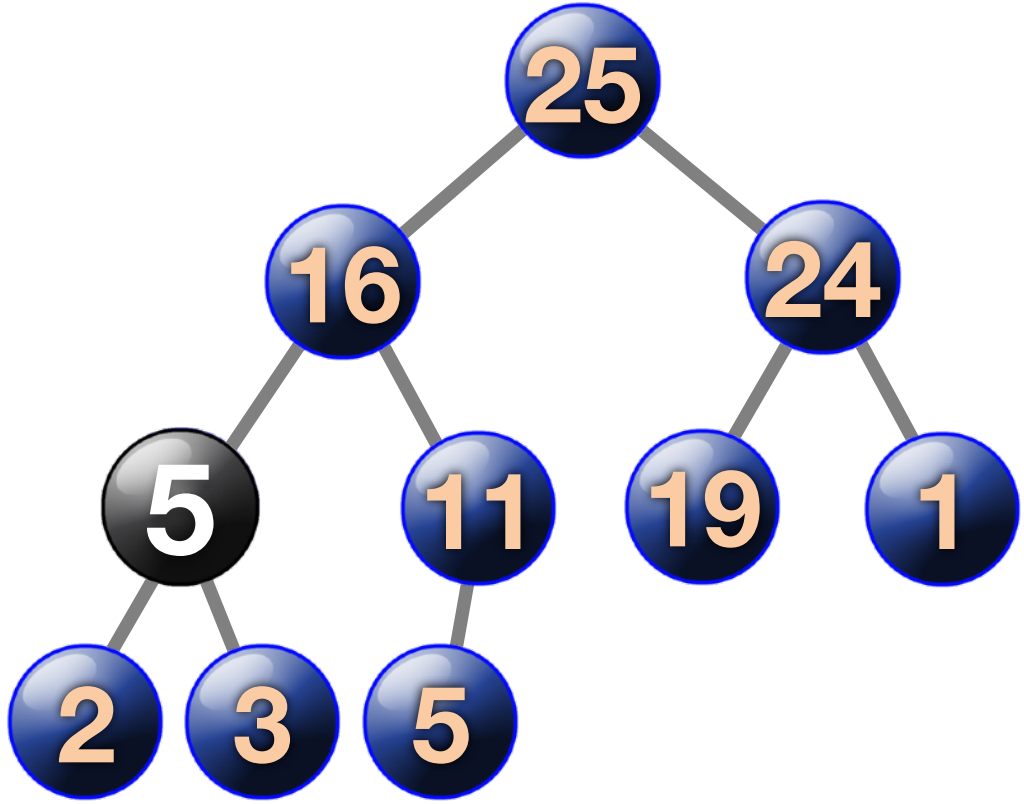
Easy to implement using a List



1	2	3	4	5	6	7	8	9	10
25	16	24	5	11	19	1	2	3	5

Easy to implement using a List

i = 4

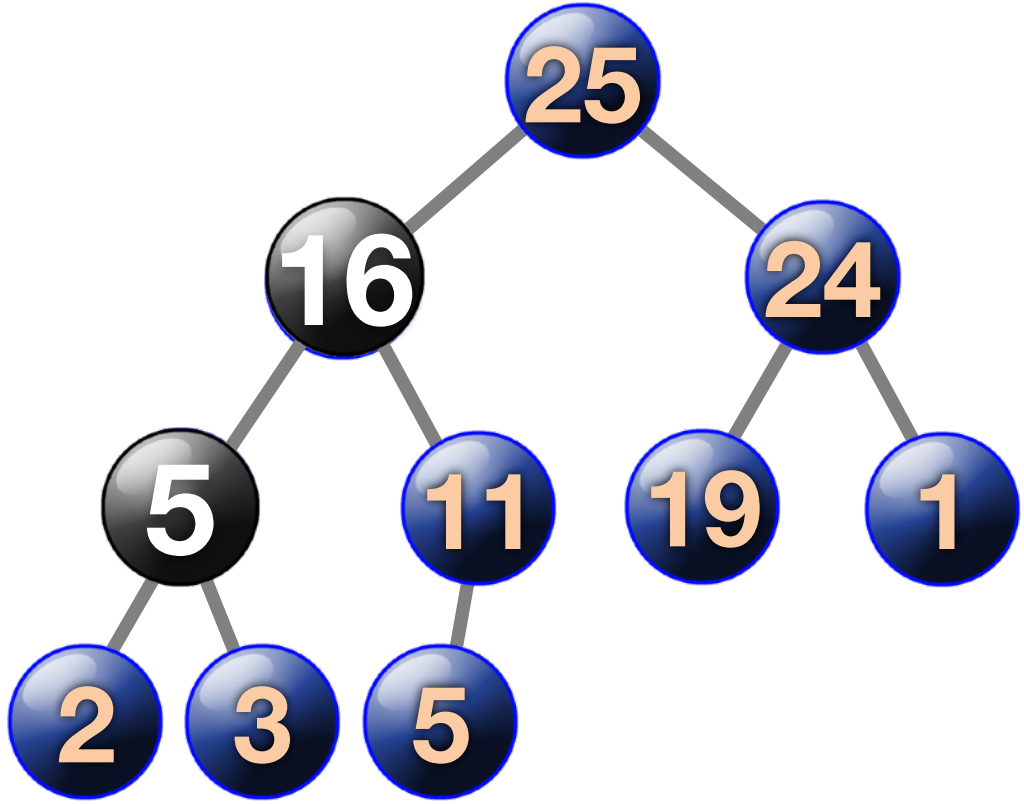


1	2	3	4	5	6	7	8	9	10
25	16	24	5	11	19	1	2	3	5

Easy to implement using a List

i = 4

parent(i) = i/2 = 2



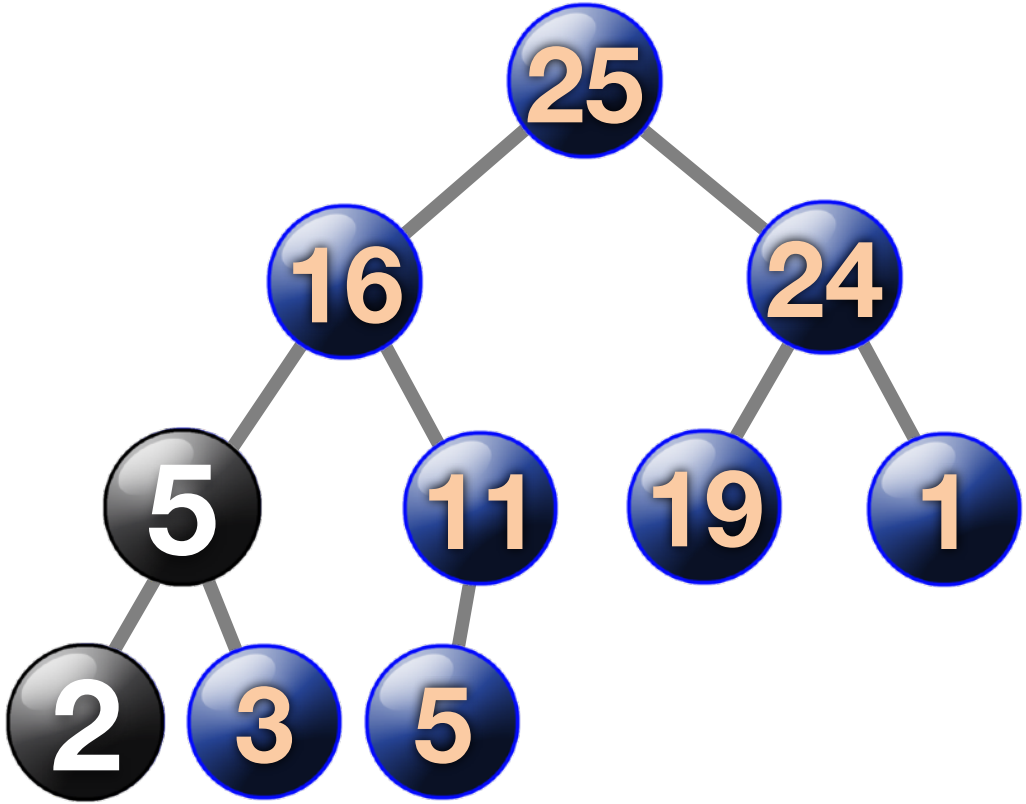
1	2	3	4	5	6	7	8	9	10
25	16	24	5	11	19	1	2	3	5

Easy to implement using a List

i = 4

parent(i) = i/2 = 2

left(i) = i * 2 = 8



1	2	3	4	5	6	7	8	9	10
25	16	24	5	11	19	1	2	3	5

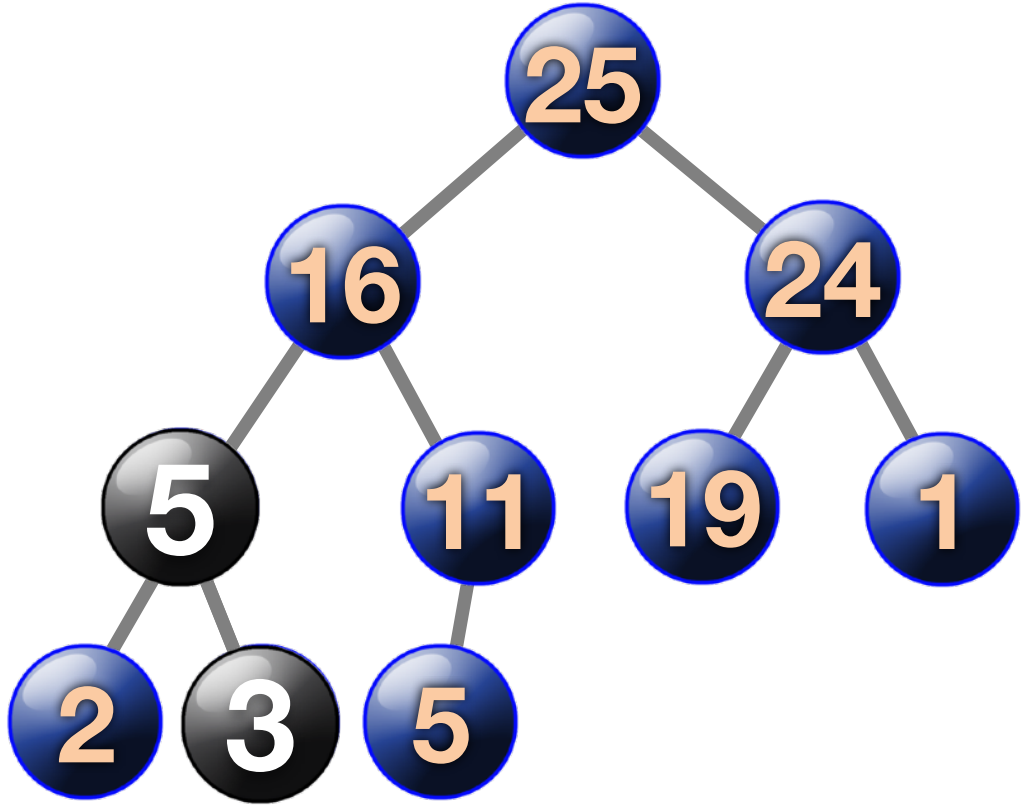
Easy to implement using a List

i = 4

parent(i) = i/2 = 2

left(i) = i * 2 = 8

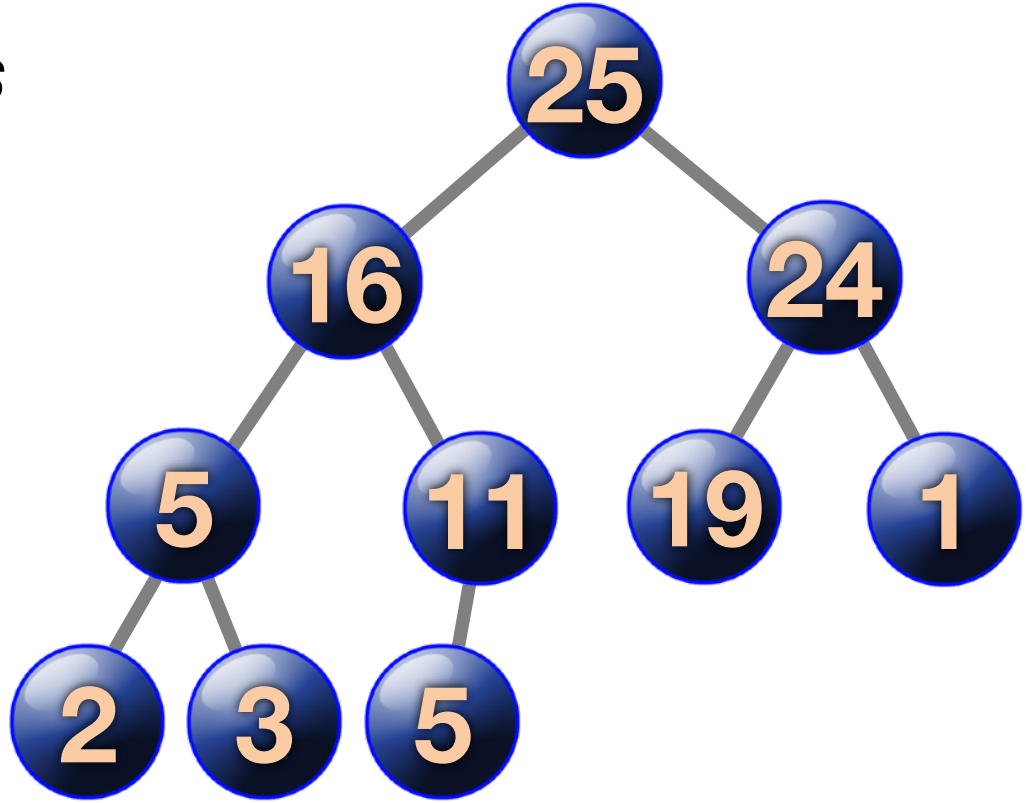
right(i) = i * 2 + 1 = 9



1	2	3	4	5	6	7	8	9	10
25	16	24	5	11	19	1	2	3	5

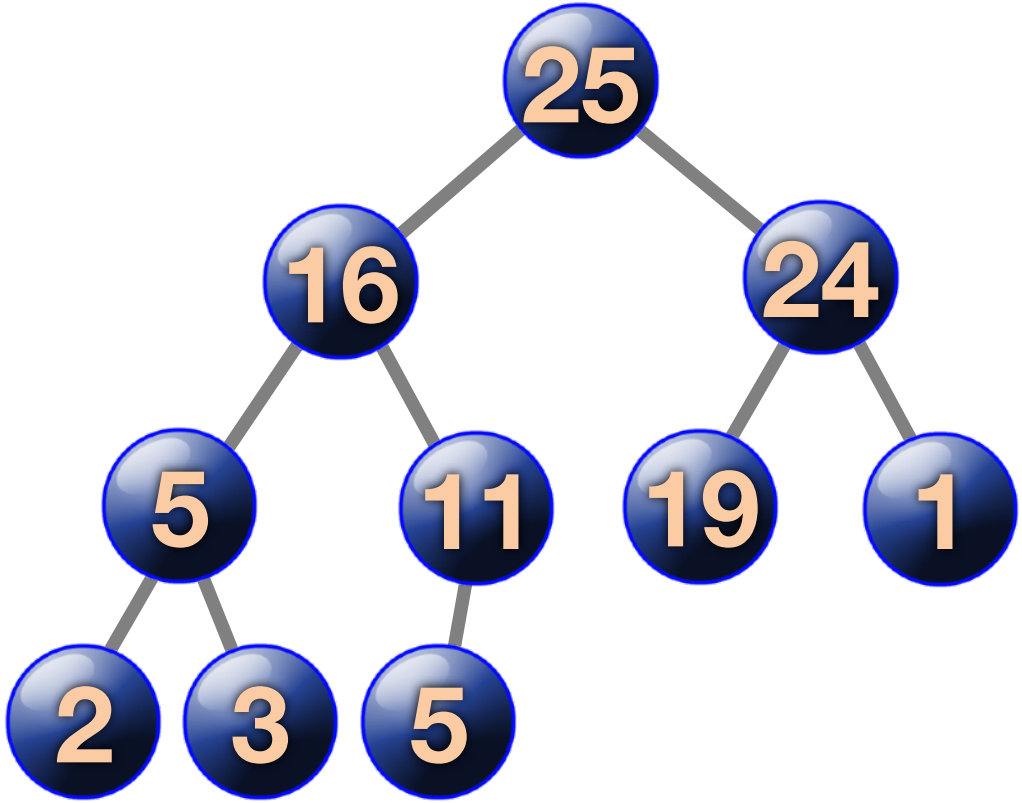
MaxHeap Operations

- Push (insert)
- Peek (get max)
- Pop (remove max)



Push

- Add value to end of array
- Float it Up to its proper position



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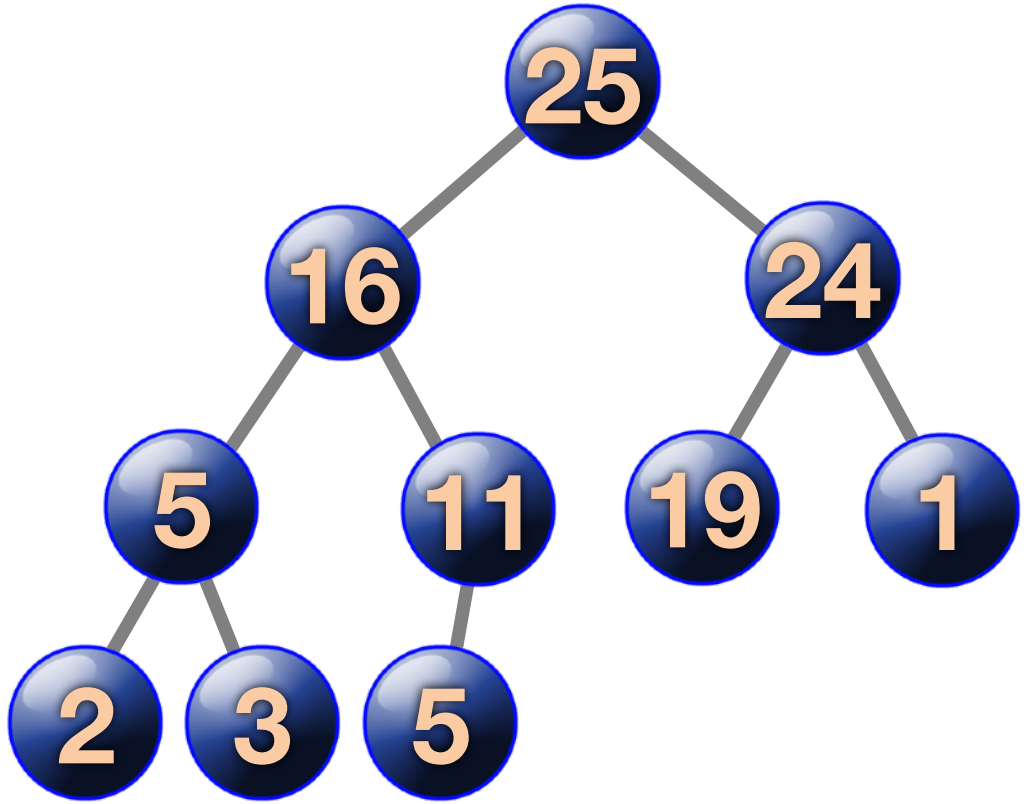

Push

- Add value to end of array
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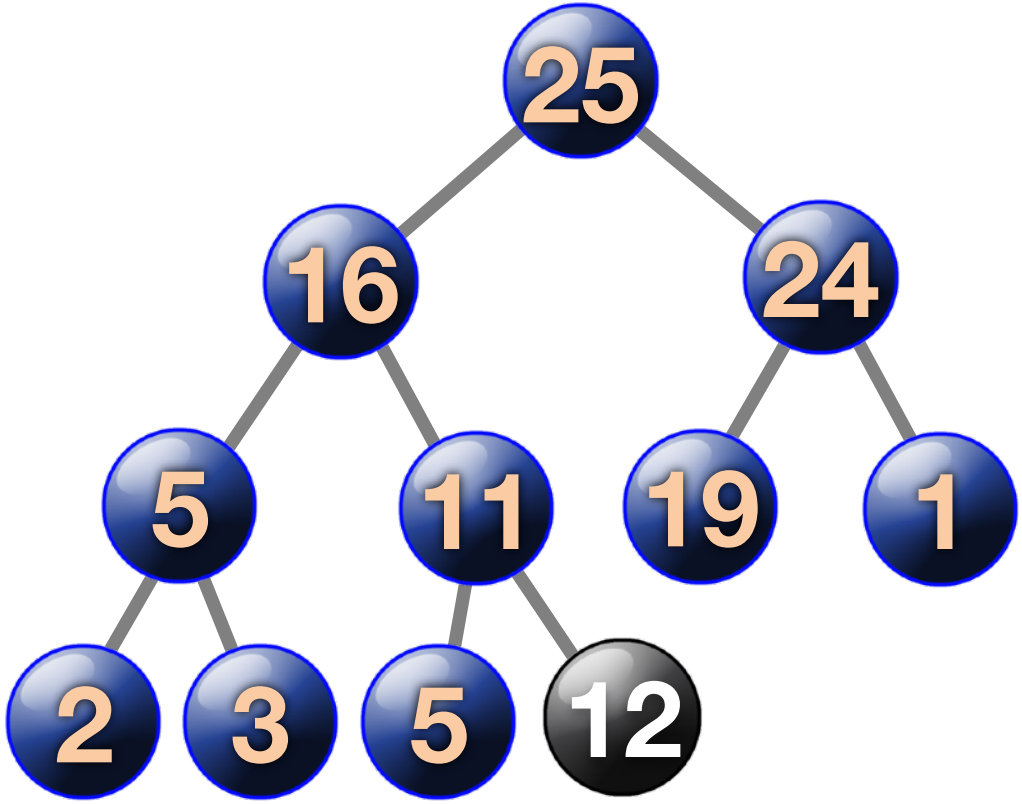

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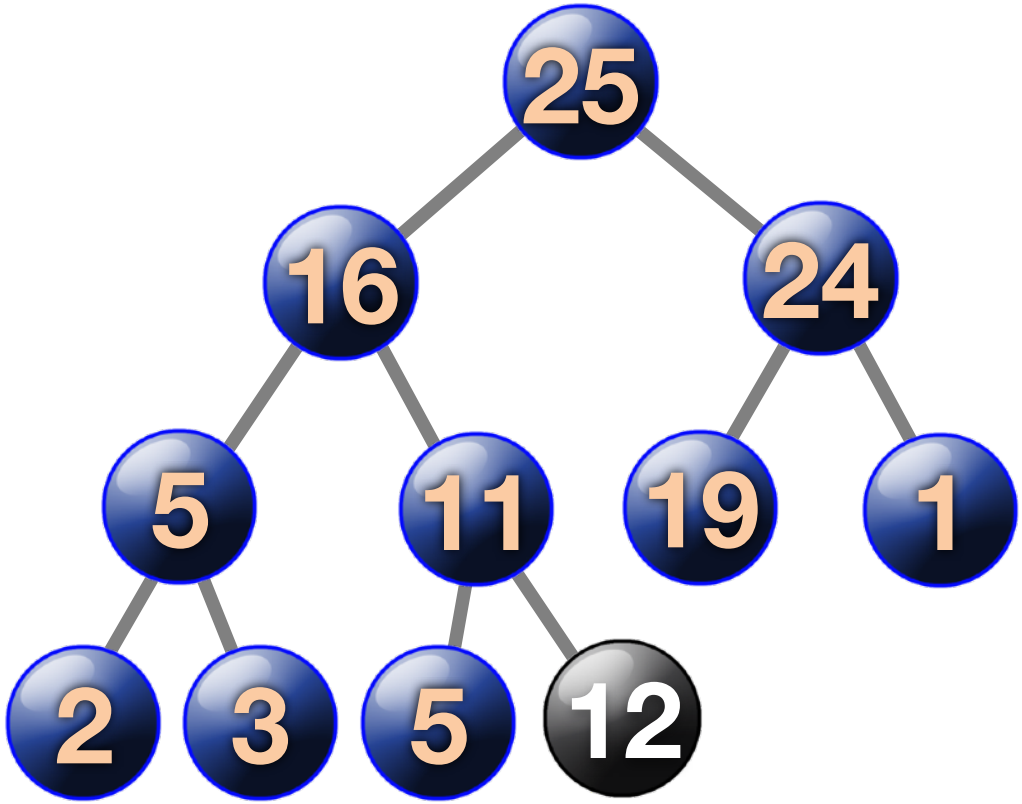
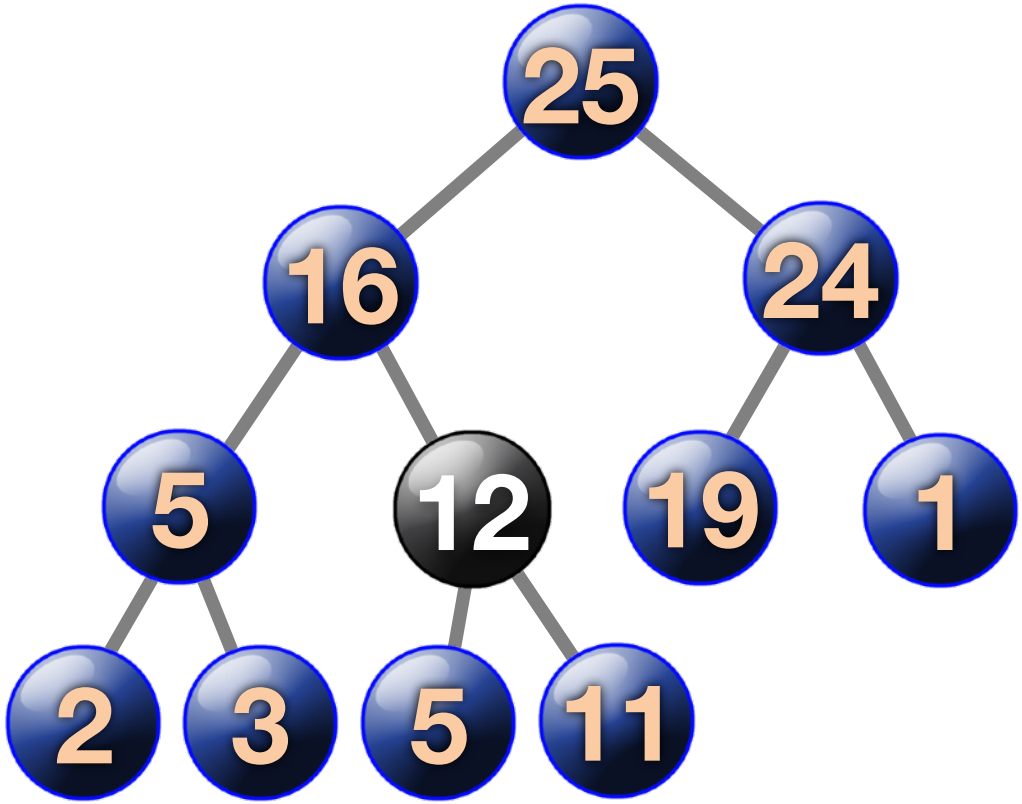


12 > 11 ?

Push

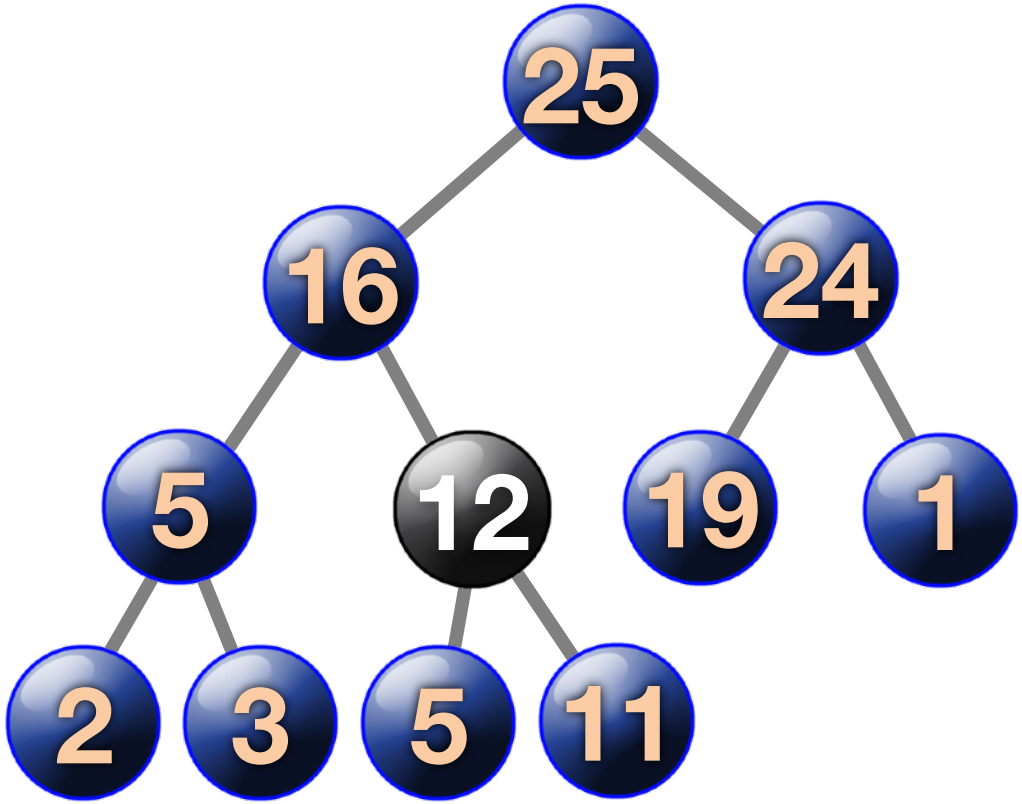
- Add value to end of array
- Float it Up to its proper position



12 > 11 ?

Push

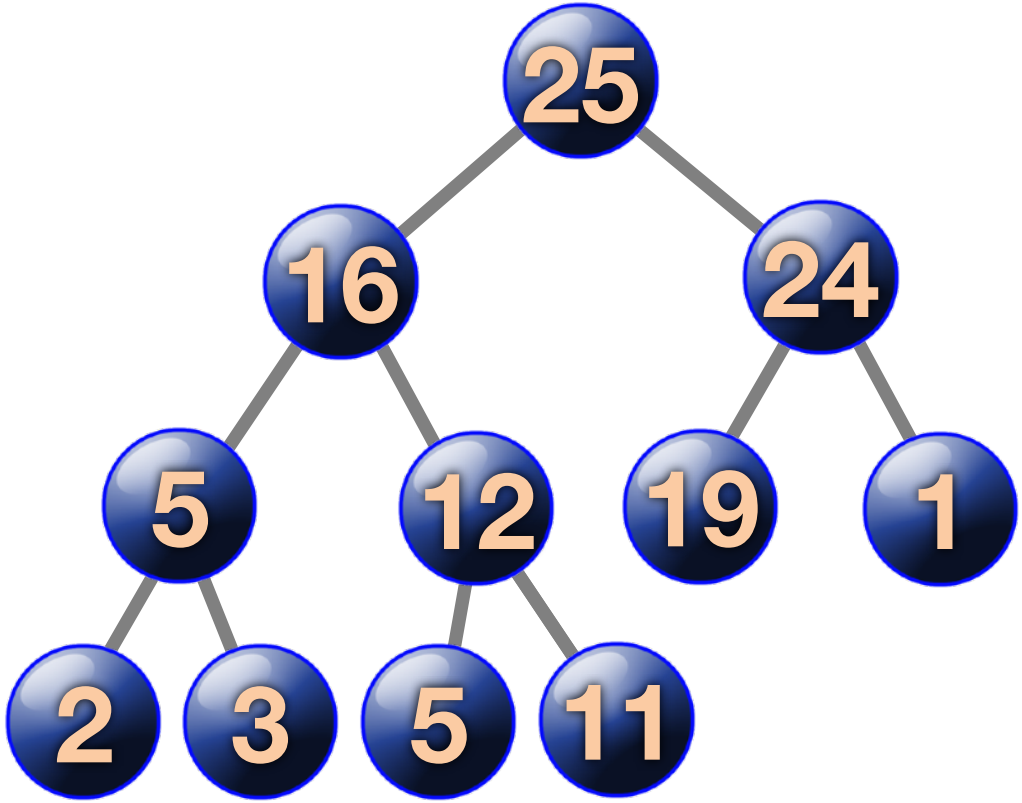
- Add value to end of array
- Float it Up to its proper position



12 > 16 ?

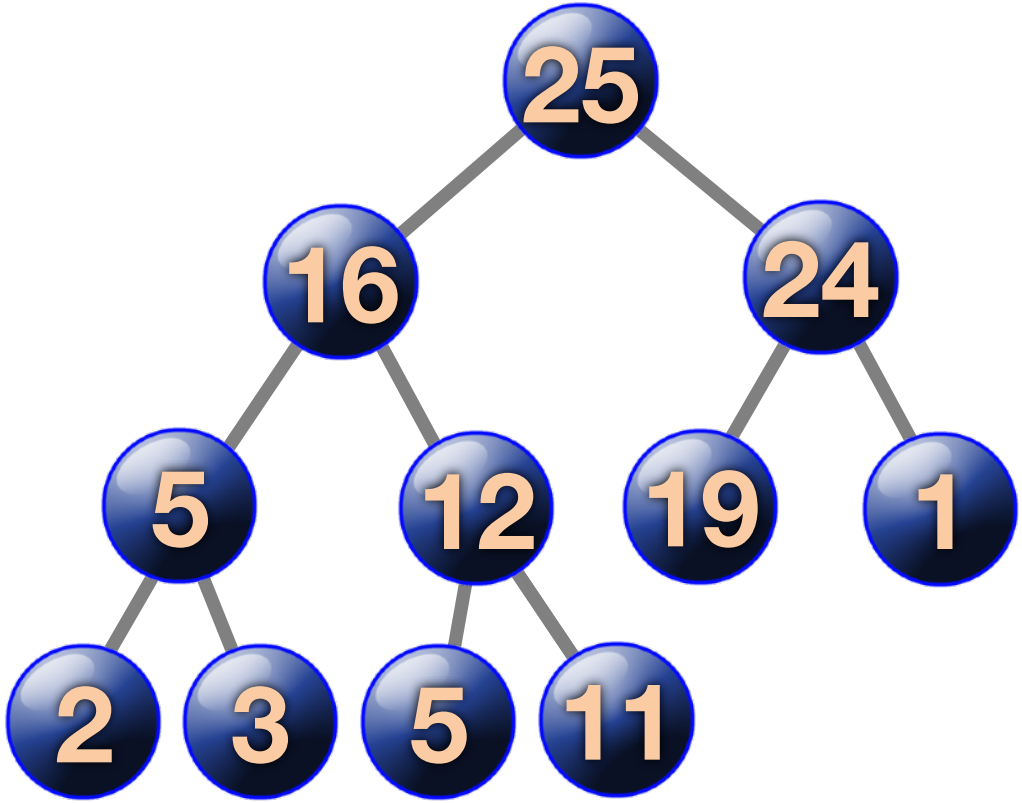
Peek

- Return the value at heap[1]



Pop

- Move max to end of array
- Delete it
- Bubble Down the item at index 1 to its proper position
- Return max



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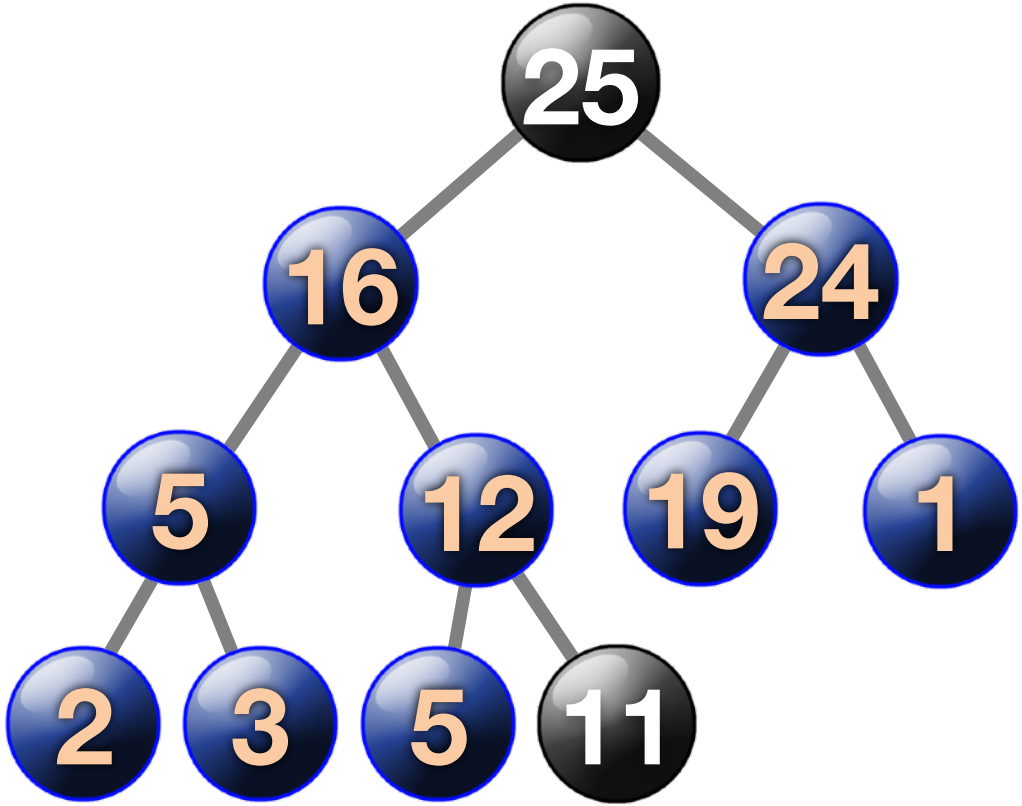

Pop

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- Bubble Down the item at index 1 to its proper position
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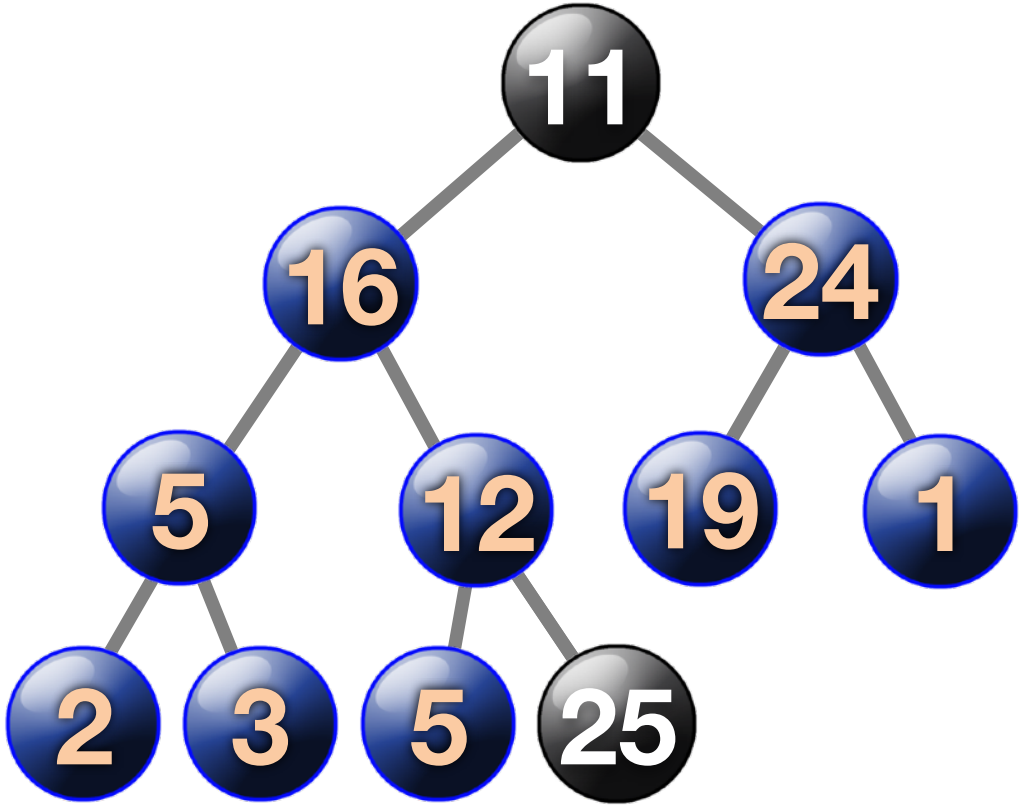

Pop

- Move max to end of array
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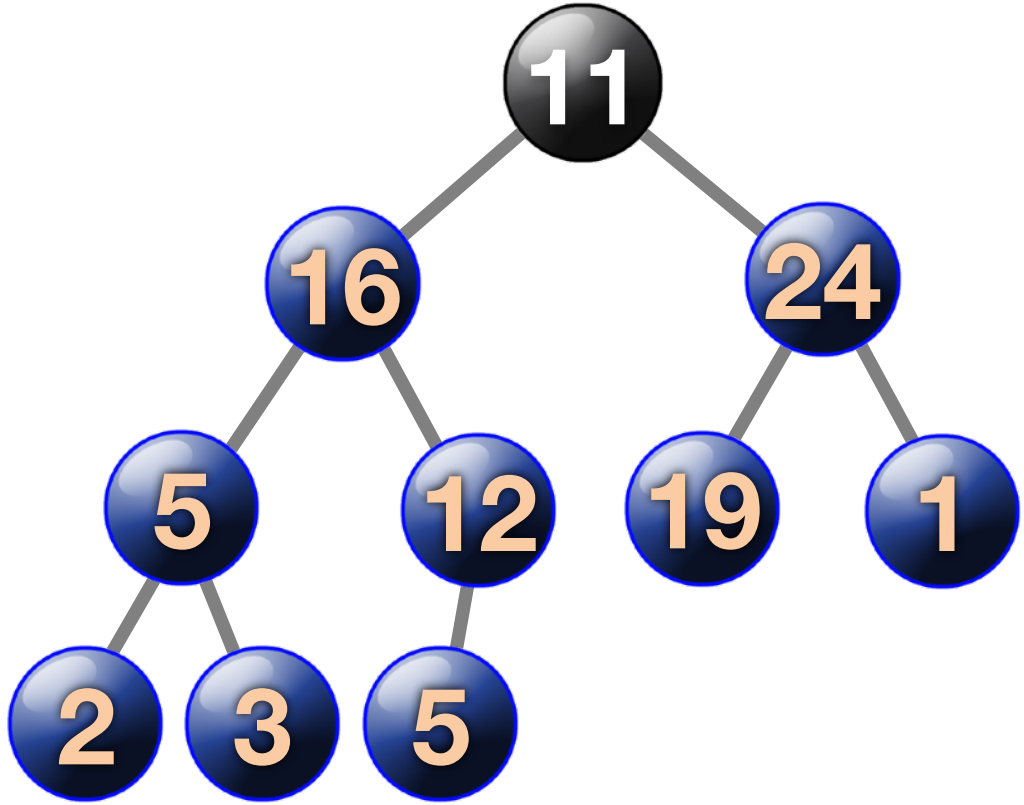
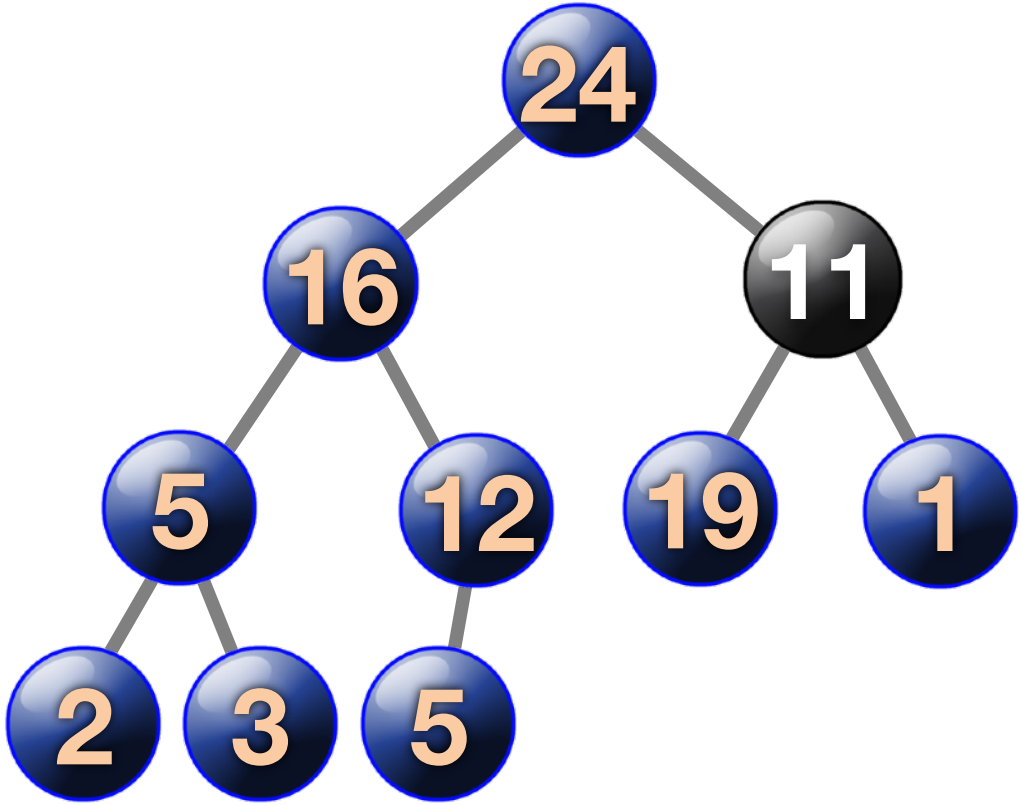


Pop

- Move max to end of array
- Delete it
- Bubble Down the item at index 1 to its proper position
- Return max



Pop

- Move max to end of array
- Delete it
- Bubble Down the item at index 1 to its proper position
- Return max