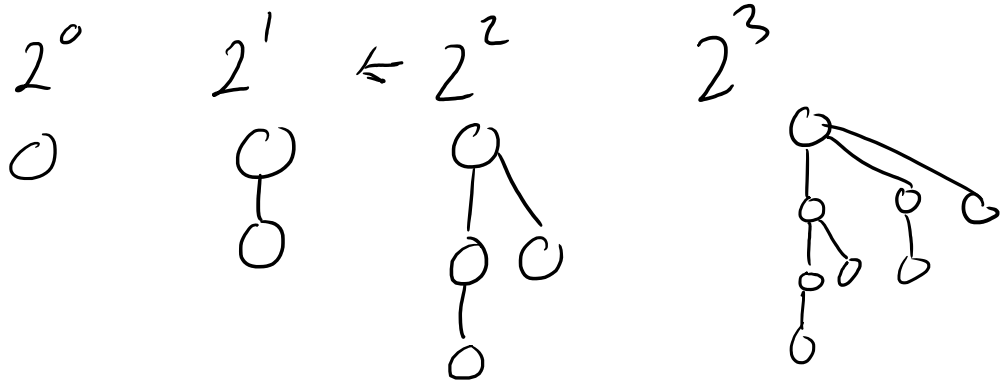
2018-10-04 Binomial & Skew Heaps

Thursday, October 4, 2018 3:01 PM

Binomial Heaps

- Are "forests" of mini heap trees
- Each heap tree is a power of 2 in size and is recursively constructed from prior heap sizes

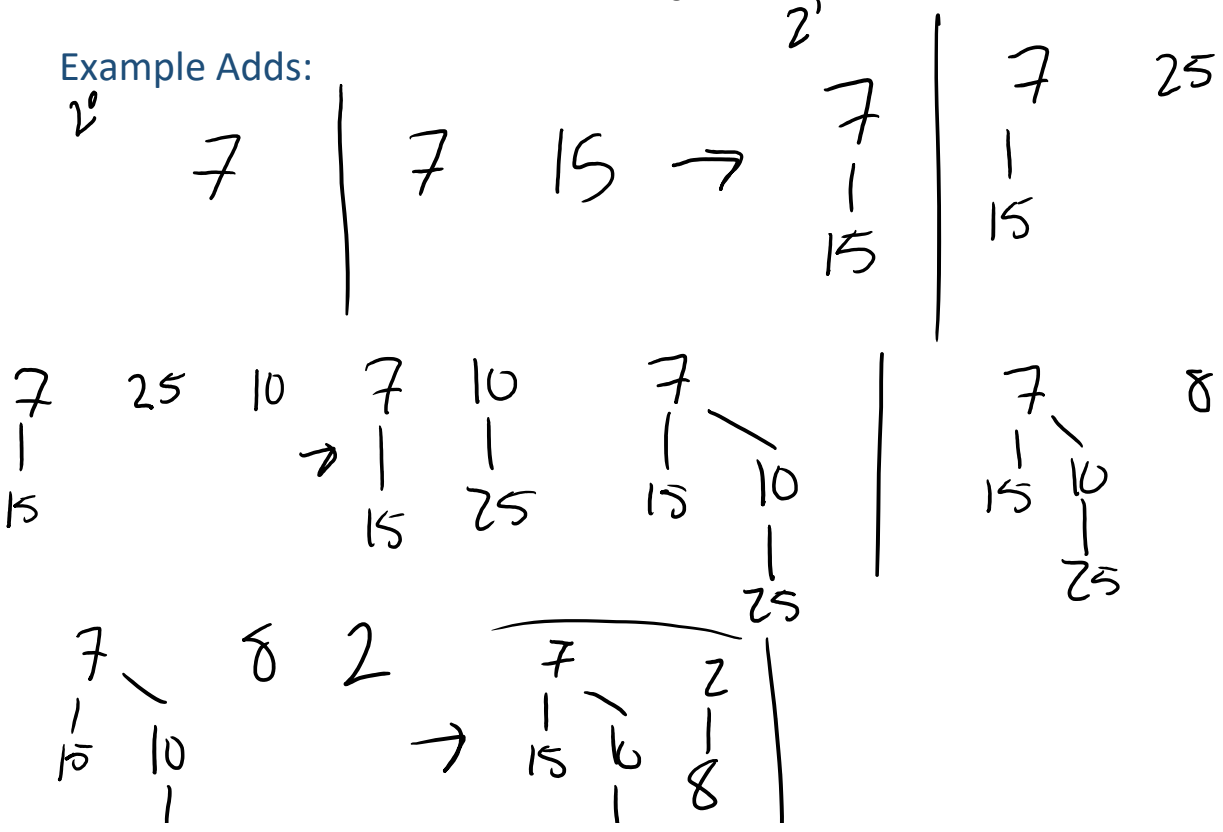


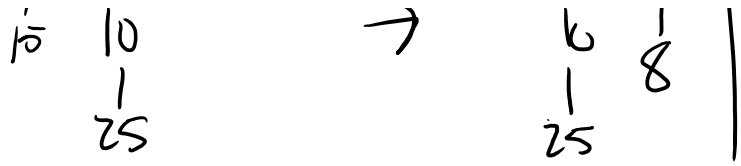
- Thus, a binomial heap has multiple "root" values.

Binomial Heap Rules

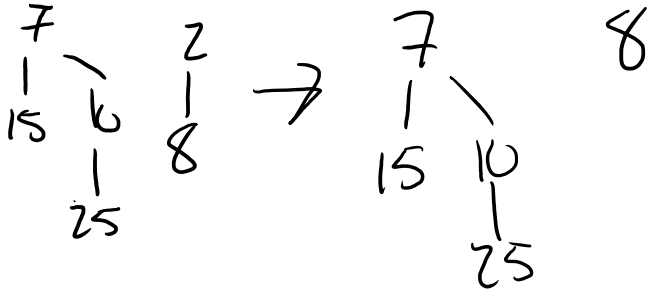
- Each tree in a binomial forest must have a unique size
- All nodes below a given node must be less important than that node
- New values are added to the heap as a singleton (tree size 1)
  - If this causes a violation of rule #1, merge trees until rule is satisfied
- Dequeue removes the most important node in a forest.
  - If this causes a violation of rule #1, merge trees until rule is satisfied

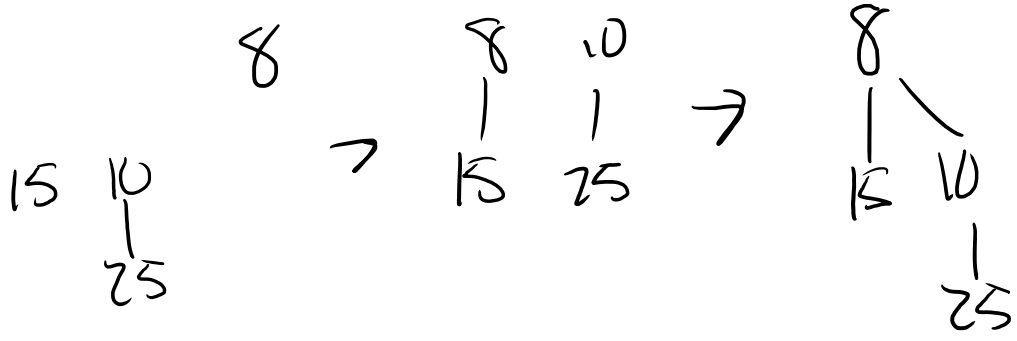
Example Adds:

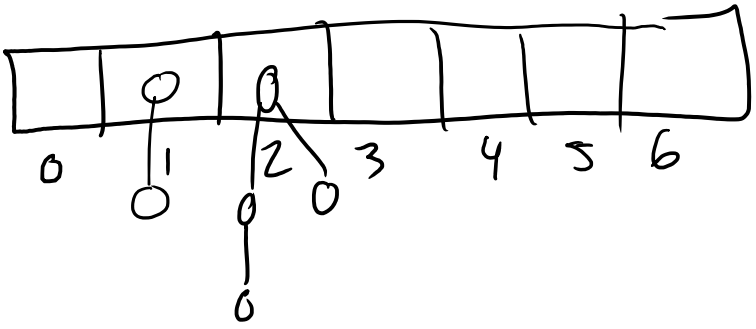


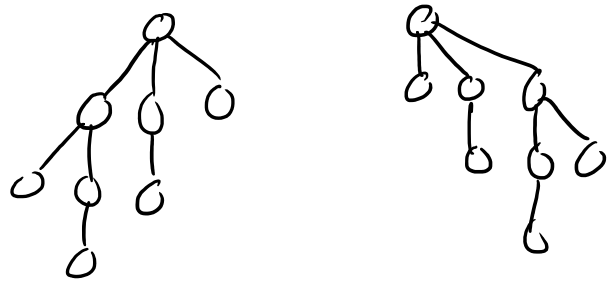


Dequeue









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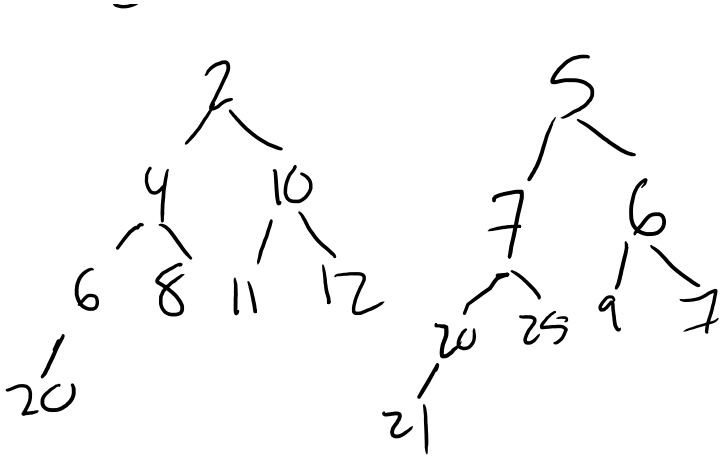


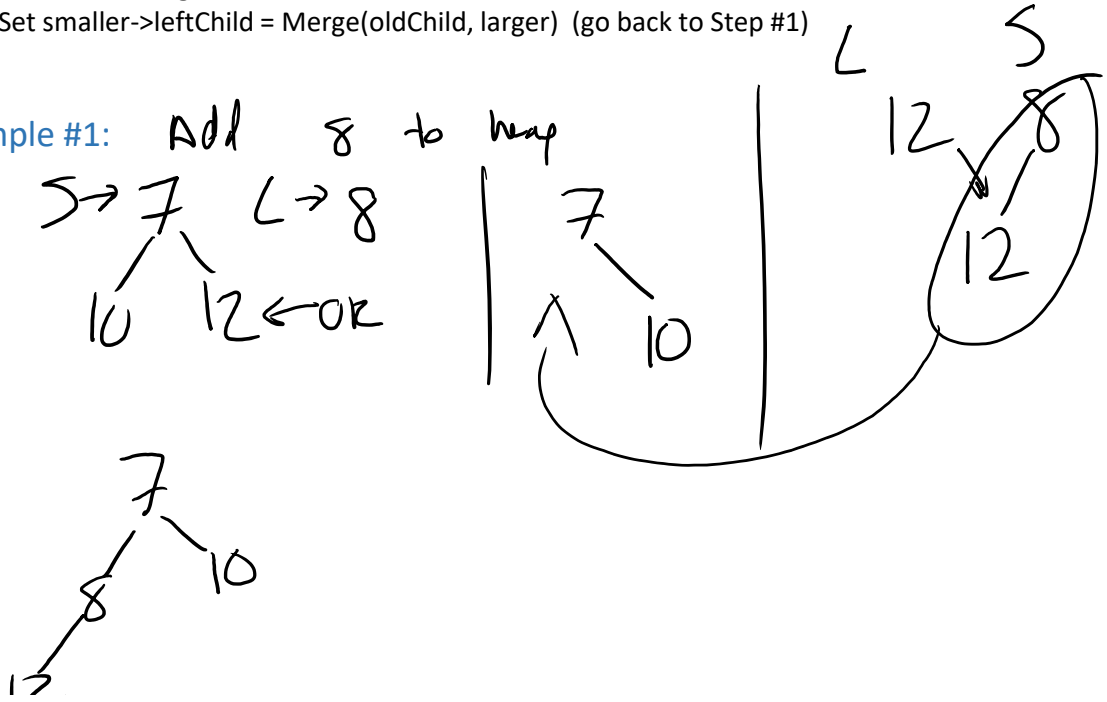
Skew Heaps

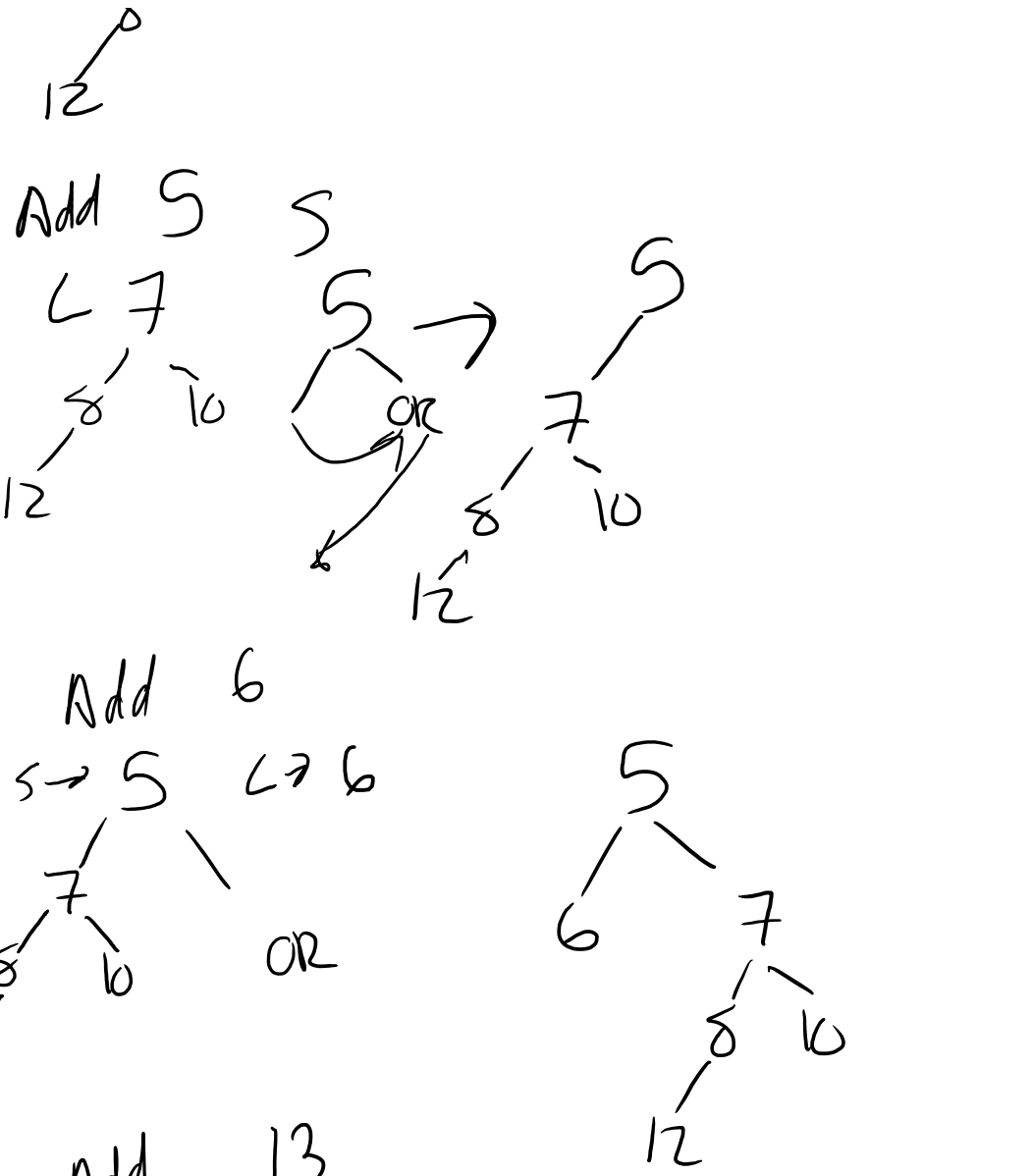
- Recall that binary heaps use vectors. This is required because:
  - We need to get the parent data
  - We need to quickly access bottom-right most element
- What if we wanted to do an LL-based implementation?
  - Different rules are required
- Skew heaps are:
  - LL-based
  - Not guaranteed to be complete
  - Not guaranteed to be balanced
  - Merge better than binary heaps
  - Have on average, LogN runtime
- Similar to binomial heaps, all Skew Heap operations follow the same basic algorithm

Basic Skew Heap Algorithm (min-heap)

1. Given two heaps, A, B
2. Let smaller = smaller(A, B)
3. Let larger = larger(A, B)
4. Let oldRight = smaller->RightChild
5. Set smaller->RightChild = smaller->LeftChild
6. Set smaller->leftChild = Merge(oldChild, larger) (go back to Step #1)

Example #1:

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Dequeue
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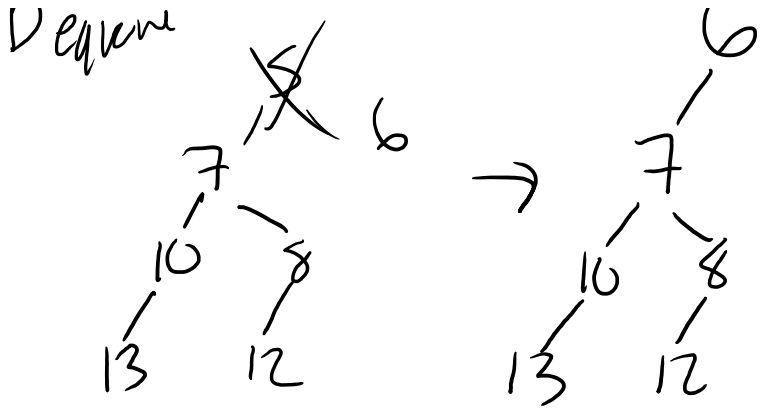
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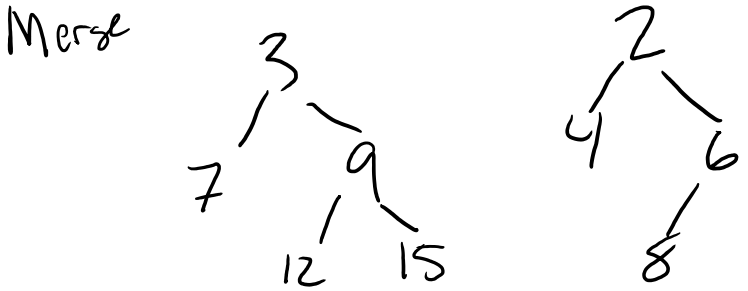
Merge
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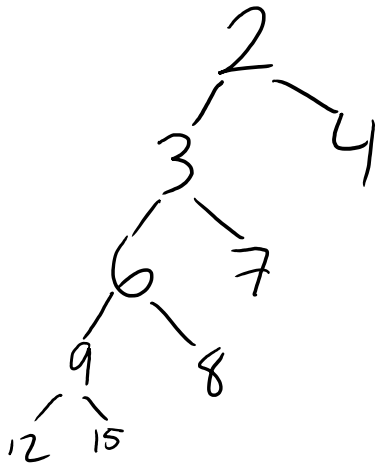
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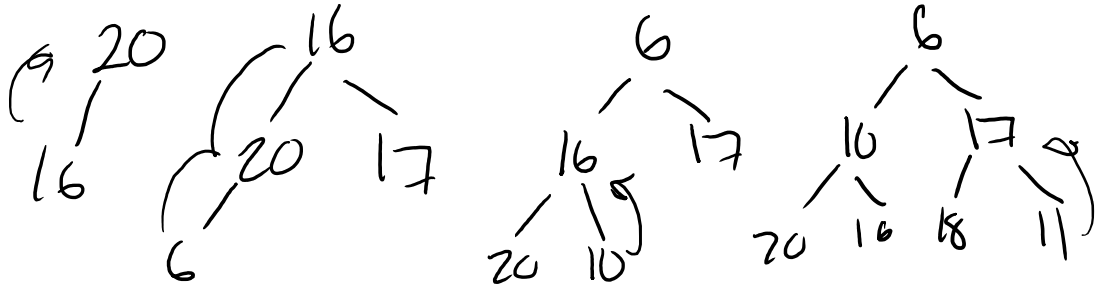
Handout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