App Academy

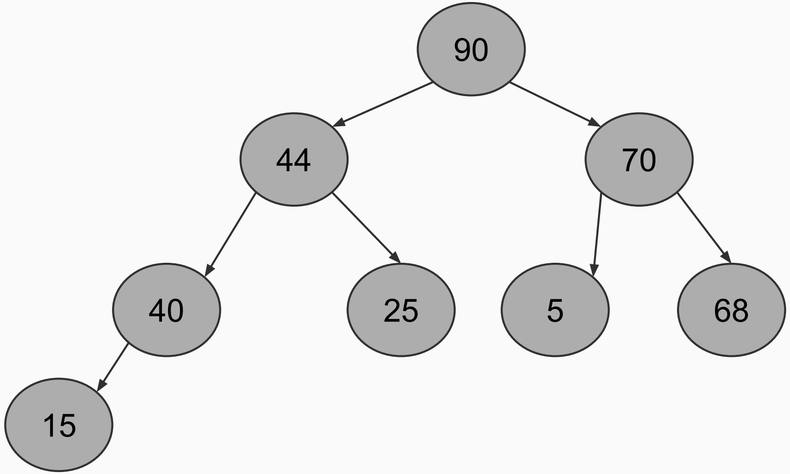
Heaps / Priority Queues

What is a heap / priority queue?

- The terms “heap” and “priority queue” are the interchangeable
- Partially ordered data structure
- Instead of “first in first out”, we want to pop out an element by priority
    - We can priority the min value or the max value
- Properties of min heap
    - Structure
        - Complete binary tree
            - “complete” means that we fill out the tree from top to bottom, left to right
        - Order property
            - Every node’s value is less than its children
                - This makes the root the minimum
- Because a heap is a complete binary tree, we can actually represent it using an array

Heap Implementation

max heap

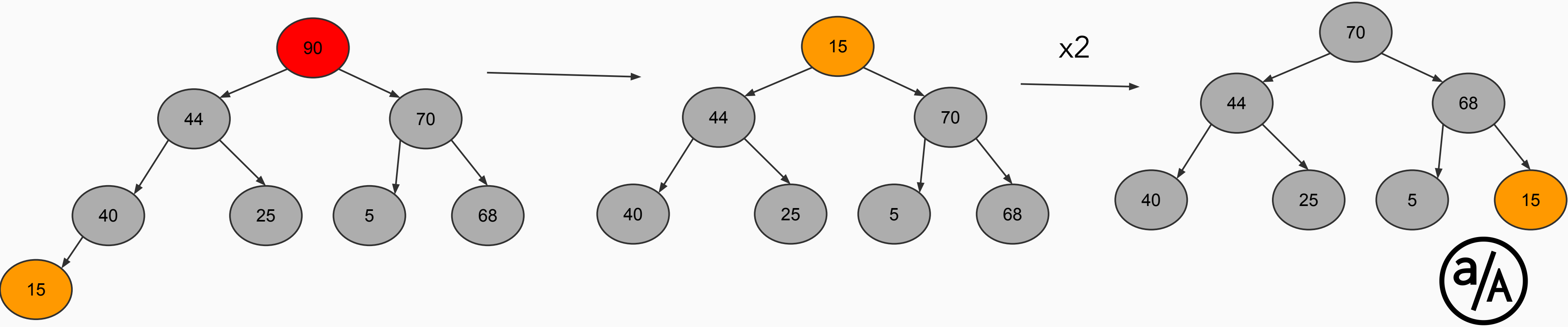


leftChild = 2*i + 1
rightChild = 2*i + 2
parent = Math.floor((i-1)/2)

val	90	44	70	40	25	5	68	15
index	0	1	2	3	4	5	6	7

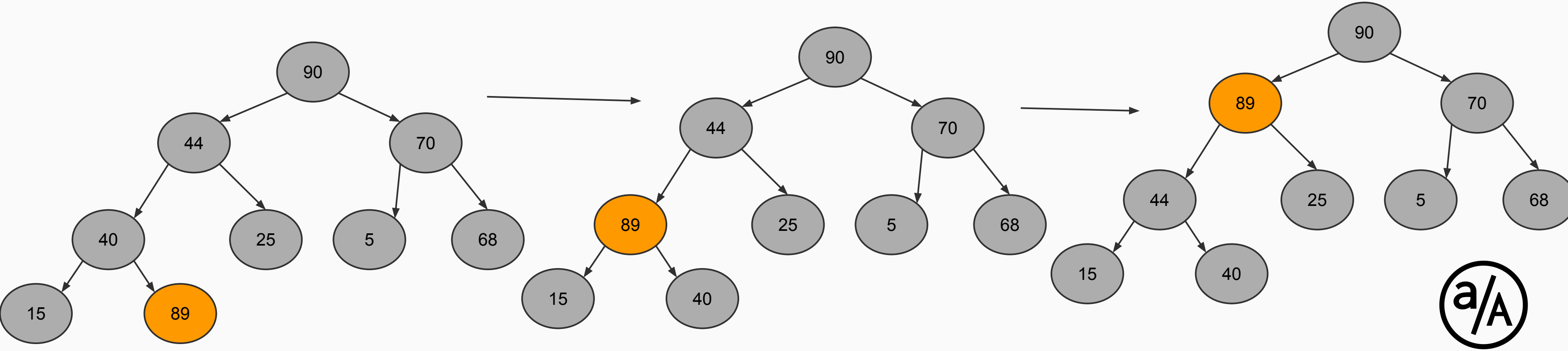
Operations of max heap

- poll
  - pop out top element
  - move last element to top
  - heapify down: recursively compare children, swap with bigger child



Operations of max heap

- push
  - insert element at ended
  - heapify up: recursively it with parent, swap if parent is larger
- heapify
  - In order to convert a set of values to a heap, we would need to push each of the values one by one into the heap



Runtimes

Operations	Big-O Time
Push	O(log(n))
Poll	O(log(n))
Heapify	O(n)
Peek	O(1)
Search	O(n)

Demo

Questions?

Let’s practice!

- Review
    - Last Stone Weight
    - Kth Largest Element in a Stream