CSE12 - Lecture 20 - B00

Wednesday, November 9, 2022 9:00 AM

PA7 released today
PA6 hard deadline → tonight 11:59pm
PA4 late / resubmit → Tuesday
Friday - holiday → no class
Exam 2 → Friday of Week 8 → 11/18
↳ counting steps, run-time, sorting, hash tables

Max Heap → largest value comes out first

Assume the key and value are identical for this example

Draw the picture of the tree and the array for the following:

ArrayList<Integer> heap = new ArrayList<>(2); //initial capacity of 2

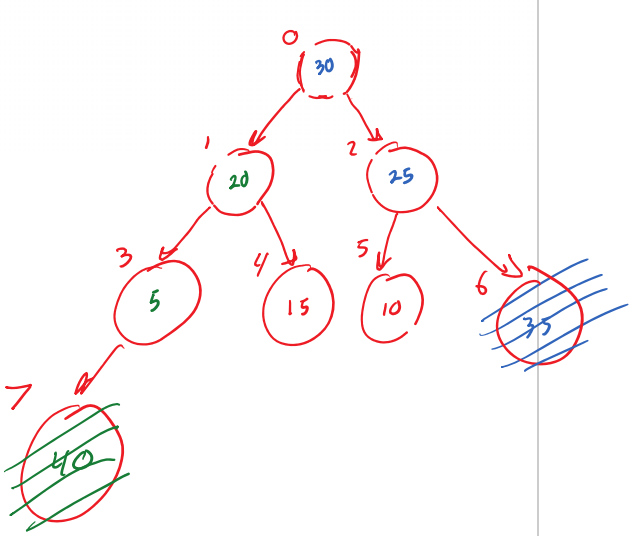
Add the following elements to the max heap (in this order):

5, 10, 15, 20, 25, 30, 35, 40

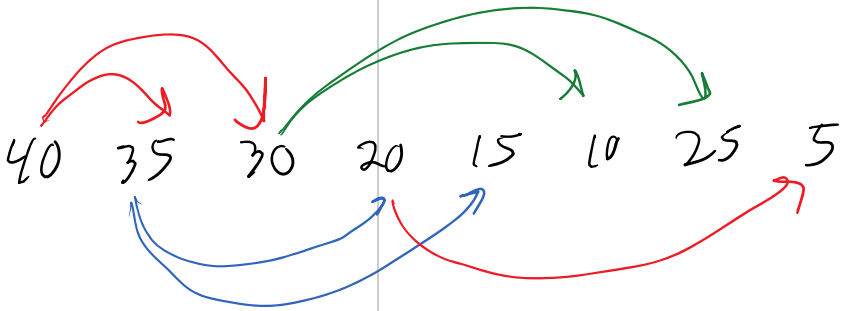
Call poll() twice

What elements were returned?

add(5)
add(10)
add(15)
add(20)
add(25)
add(30)
add(35)
add(40)
poll()
↙ 40
poll()
↙ 35



height
↳ $\log_2(N)$



```
void bubbleDown(int index) {
   if(index >= this.entries.size()) { return; }
   int leftIndex = left(index);
   if(leftIndex >= this.entries.size()) { return; }
   int largerChildIndex = leftIndex;
   int rightIndex = right(index);
   if(existsAndGreater(rightIndex, leftIndex)) {
      largerChildIndex = rightIndex;
   }
   if(existsAndGreater(largerChildIndex, index)) {
      swap(index, largerChildIndex);
      bubbleDown(largerChildIndex);
   }
}

void bubbleUp(int index) {
   if(index <= 0) { return; }
   Entry<K,V> e = this.entries.get(index);
   Entry<K,V> parent = this.entries.get(parent(index));
   int comp = this.comparator.compare(e.key, parent.key);
   if(comp > 0) {
      swap(index, parent(index));
      bubbleUp(parent(index));
   }
   else {
      return;
   }
}
```

What is the run-time for a Max Heap

add()

Worst Case $\Theta(\log_2(N))$

What conditions make up the worst case for add()?

sorted for max heap

Best Case: $\Theta(1)$

What conditions make up the best case for add()?

added key already in heap order

Max heap → reverse sorted list

min heap → sorted

poll()

Worst Case $\Theta(\log_2(N))$

What conditions make up the worst case for poll()?

smallest # was last added

Best Case: $\Theta(1)$

What conditions make up the best case for poll()?

duplicate #s