

CSE12 - Lecture 20

Monday, November 20, 2023 8:00 AM

PA7 and PA5 Late/Resubmit - due Wednesday @ 8am
No class on Friday - holiday

Lecture 20

Max Heap

largest value comes out first
is the root

complete tree \rightarrow filled in left to right
max heap \rightarrow parent keys \geq children keys

Priority Queue

Assume the key and value are identical for this example

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

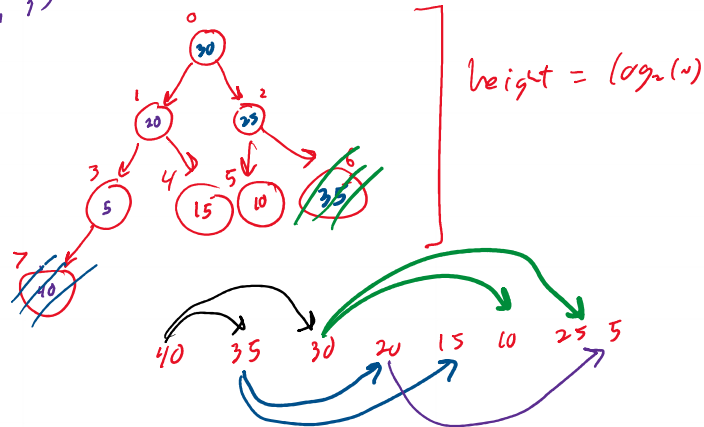
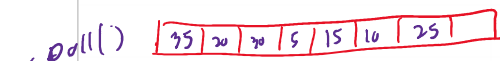
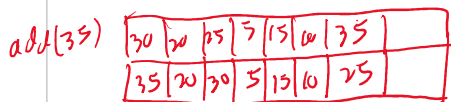
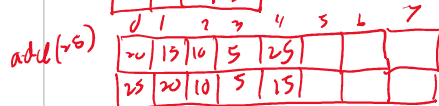
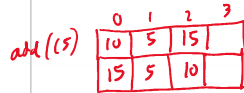
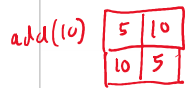
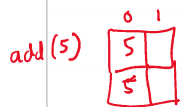
`ArrayList<Integer> heap = new ArrayList<>(2); //initial capacity of 2`

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? 40, 35



Name: _____ PID: _____ Code: 5812

```

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 order for max heap

Best Case: $\Theta(1)$

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

*some have
heap \rightarrow no duplicate keys
 \rightarrow do have duplicate keys (not)*

max heap \rightarrow reverse sorted list

min heap \rightarrow sorted list

poll()

Worst Case

$$\Theta(\log_2(n))$$

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

small #s at the bottom

Best Case: $\Theta(1)$

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

all duplicate keys