

Objective(s):

- a. To understand heap insertion and removal mechanism.
- b. To understand the relationship between heap and priority queue.

### Task 1: MyMinHeap

Implement MyMinHeap.Java, inside package \Lab09\pack.

implement insert(int d) and int remove() methods. (MAX\_SIZE = 100)

```
import code.*;
public class L9_PQ_Main {
    static ArrayList<Integer> least3;

    public static void main(String[] args) {
        // println("-task1---");
        // task_1();
        // println("-task2---");
        // task_2();
    }
    static void task_1 () {
        least3 = new ArrayList<>();
        MyMinHeap heap = new MyMinHeap();
        heap.insert(11);    heap.insert(15);
        heap.insert(16);    heap.insert(13);
        heap.insert(17);    heap.insert(18);
        println("heap strucutre is " + heap);
        least3.add(heap.remove());
        least3.add(heap.remove());
        least3.add(heap.remove());
        println("least 3 value is " + least3);
    }
    static void task_2() {
        least3 = new ArrayList<>();
        MyPriorityQueue pq = new MyPriorityQueue();
        pq.enqueue(11);    pq.enqueue(15);
        pq.enqueue(16);    pq.enqueue(13);
        pq.enqueue(17);    pq.enqueue(18);
        pq.enqueue(19);    // <-- isFull() is true ... discard
        println("pq structure is " + pq);
        least3.add(pq.dequeue());
        least3.add(pq.dequeue());
        least3.add(pq.dequeue());
        println("least 3 value is " + least3);
    }
}
```

Implement boolean isFull(), boolean isEmpty() and int peek() for task\_2()

**Task 2:** Given an abstract class MyQueueInterface.java, implement MyPriorityQueue.java from MyMinHeap's capabilities.

```
package code;

public interface MyQueueInterface {
    public void enqueue(int d);
    public int dequeue();
    public int front();
    public boolean isFull();
    public boolean isEmpty();
}
```

**Task 3:** draw / write the heap snapshot during each dequeue() was performed.

### Task 3: Comparator for Priority Queue

Java collections provide a PriorityQueue class. It is an unbounded priority queue based on a priority heap. The elements of the priority queue are ordered according to their natural ordering, or by a Comparator provided at queue construction time, depending on which constructor is used.<sup>1</sup>

An example of working with a priority queue is as follows.

```
static void task_3() {
    PriorityQueue<Employee> pq = new PriorityQueue<>(
        (e1,e2) -> Integer.compare(e1.salary,e2.salary));

    List<Employee> list = Arrays.asList(new Employee("Yindee", 2000),
                                         new Employee("Preeda",1500),
                                         new Employee("Pramote", 3000));
    pq.addAll(list);
    System.out.println(pq);
    // [Emp Preeda(1500), Emp Yindee(2000), Emp Pramote(3000)]
}
```

### Task 4: Challenge Example

#### 1046. Last Stone Weight

Solved

You are given an array of integers `stones` where `stones[i]` is the weight of the  $i^{\text{th}}$  stone.

We are playing a game with the stones. On each turn, we choose the **heaviest two stones** and smash them together. Suppose the heaviest two stones have weights  $x$  and  $y$  with  $x \leq y$ . The result of this smash is:

- If  $x = y$ , both stones are destroyed, and
- If  $x \neq y$ , the stone of weight  $x$  is destroyed, and the stone of weight  $y$  has new weight  $y - x$ .

At the end of the game, there is **at most one** stone left.

Return the *weight of the last remaining stone*. If there are no stones left, return `0`.

**Example 1:**

**Input:** stones = [2,7,4,1,8,1]  
**Output:** 1

**Explanation:**

We combine 7 and 8 to get 1 so the array converts to [2,4,1,1,1] then,  
we combine 2 and 4 to get 2 so the array converts to [2,1,1,1] then,  
we combine 2 and 1 to get 1 so the array converts to [1,1,1] then,  
we combine 1 and 1 to get 0 so the array converts to [1] then that's the  
value of the last stone.

```
static void task_4() {

    int lastStoneWeight = 0;
    int[] stones = {2,7,4,1,8,1};
    /* your code */
    System.out.println(lastStoneWeight);
}
```

**Submission:** MyMinHeap\_XXXXXXX, MyPriorityQueue\_XXXXXXX.java and this pdf.

Due date: TBA

<sup>1</sup> <https://docs.oracle.com/javase/8/docs/api/java/util/PriorityQueue.html>