

## Heap Solutions

Solution 1:

Time Complexity :  $O(\log k)$

Space Complexity:  $O(1)$

```
import java.io.*;
import java.util.*;

class Solution {
    static PriorityQueue<Integer> min;
    static int k;

    static List<Integer> getAllKthNumber(int arr[]){

        List<Integer> list = new ArrayList<>();
        for (int val : arr) {
            if (min.size() < k)
                min.add(val);
            else {
                if (val > min.peek()) {
                    min.poll();
                    min.add(val);
                }
            }

            if (min.size() >= k)
                list.add(min.peek());
            else
                list.add(-1);
        }
        return list;
    }

    public static void main(String[] args){
        min = new PriorityQueue<>();
        k = 4;
        int arr[] = { 1, 2, 3, 4, 5, 6 };
        List<Integer> res = getAllKthNumber(arr);
        for (int x : res)
            System.out.print(x + " ");
    }
}
```

```
}
```

## Solution 2 :

Time Complexity :  $O(n)$

Space Complexity:  $O(n)$

```
import java.io.*;
import java.util.*;
class Solution{
    public static void minTime(int arr[],
                                int N, int K){

        Queue<Integer> q = new LinkedList<>();

        boolean vis[] = new boolean[N + 1];
        int time = 0;

        for (int i = 0; i < K; i++) {
            q.add(arr[i]);
            vis[arr[i]] = true;
        }

        while (q.size() > 0) {
            for (int i = 0; i < q.size(); i++) {
                int curr = q.poll();
                if (curr - 1 >= 1 &&
                    !vis[curr - 1]) {
                    vis[curr - 1] = true;
                    q.add(curr - 1);
                }

                if (curr + 1 <= N &&
                    !vis[curr + 1]) {
                    vis[curr + 1] = true;
                    q.add(curr + 1);
                }
            }
            time++;
        }
    }
}
```

```

    }

    System.out.println(time - 1);
}

public static void main(String[] args){
    int N = 6;
    int arr[] = { 2, 6 };
    int K = arr.length;
    minTime(arr, N, K);
}
}

```

### Solution 3 :

Time Complexity :  $O(n^2 \log n)$

Space Complexity:  $O(n^2)$

```

import java.util.Stack;

class Solution{
    static String decode(String str){
        Stack<Integer> integerstack = new Stack<>();
        Stack<Character> stringstack = new Stack<>();
        String temp = "", result = "";
        for (int i = 0; i < str.length(); i++){
            int count = 0;
            if (Character.isDigit(str.charAt(i))){
                while (Character.isDigit(str.charAt(i))){
                    count = count * 10 + str.charAt(i) - '0';
                    i++;
                }

                i--;
                integerstack.push(count);
            }

            else if (str.charAt(i) == ' '){
                temp = "";
                count = 0;
            }
        }
    }
}

```

```
        if (!integerstack.isEmpty()){
            count = integerstack.peak();
            integerstack.pop();
        }

        while (!stringstack.isEmpty() && stringstack.peak()!='['){
            temp = stringstack.peak() + temp;
            stringstack.pop();
        }

        if (!stringstack.empty() && stringstack.peak() == '[')
            stringstack.pop();

        for (int j = 0; j < count; j++)
            result = result + temp;

        for (int j = 0; j < result.length(); j++)
            stringstack.push(result.charAt(j));

        result = "";
    }

    else if (str.charAt(i) == '['){
        if (Character.isDigit(str.charAt(i-1)))
            stringstack.push(str.charAt(i));

        else{
            stringstack.push(str.charAt(i));
            integerstack.push(1);
        }
    }

    else
        stringstack.push(str.charAt(i));
}

while (!stringstack.isEmpty()){
    result = stringstack.peak() + result;
    stringstack.pop();
}
```

```
        }  
        return result;  
    }  
  
    public static void main(String args[]){  
        String str = "3[b2[ca]]";  
        System.out.println(decode(str));  
    }  
}
```

#### Solution 4 :

Time Complexity :  $O(n \log n)$

Space Complexity:  $O(n)$

```
import java.util.*;  
import java.io.*;  
  
class Solution{  
  
    static int minops(ArrayList<Integer> nums){  
        int sum = 0;  
        for(int i = 0 ; i < nums.size() ; i++){  
            sum += nums.get(i);  
        }  
  
        PriorityQueue<Integer> pq = new PriorityQueue<Integer>();  
        for(int i = 0 ; i < nums.size() ; i++){  
            pq.add(-nums.get(i));  
        }  
  
        double temp = sum;  
        int cnt = 0;  
        while (temp > sum / 2) {  
            int x = -pq.peek();  
            pq.remove();  
            temp -= Math.ceil(x * 1.0 / 2);  
            pq.add(x / 2);  
            cnt++;  
        }  
    }  
}
```

```
        return cnt;
    }

    public static void main(String args[]){
        ArrayList<Integer> nums = new ArrayList<Integer>(
            List.of(
                4, 6, 3, 9, 10, 2
            )
        );
        int count = minops(nums);
        System.out.println(count);
    }
}
```

### Solution 5 :

Time Complexity :  $O(n \cdot k \cdot \log k)$

Space Complexity:  $O(k)$

```
import java.io.*;
import java.util.*;
```

```
class Node {
    int data;
    Node next;
```

```
    Node(int key){
        data = key;
        next = null;
    }
}
```

```
class NodeComparator implements Comparator<Node> {
    public int compare(Node k1, Node k2){
        if (k1.data > k2.data)
            return 1;
        else if (k1.data < k2.data)
            return -1;
        return 0;
    }
}
```

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```
}  
class Solution {  
    static Node mergeKList(Node[] arr, int K){  
        PriorityQueue<Node> queue  
            = new PriorityQueue<>(new NodeComparator());  
        Node at[] = new Node[K];  
        Node head = new Node(0);  
        Node last = head;  
        for (int i = 0; i < K; i++) {  
            if (arr[i] != null) {  
                queue.add(arr[i]);  
            }  
        }  
        if (queue.isEmpty())  
            return null;  
        while (!queue.isEmpty()) {  
            Node curr = queue.poll();  
            last.next = curr;  
            last = last.next;  
            if (curr.next != null) {  
                queue.add(curr.next);  
            }  
        }  
        return head.next;  
    }  
    public static void printList(Node node){  
        while (node != null) {  
            System.out.print(node.data + " ");  
            node = node.next;  
        }  
    }  
    public static void main(String[] args){  
        int N = 3;  
        Node[] a = new Node[N];  
        Node head1 = new Node(1);  
        a[0] = head1;  
        head1.next = new Node(3);  
        head1.next.next = new Node(5);  
        head1.next.next.next = new Node(7);  
    }  
}
```

```
Node head2 = new Node(2);  
a[1] = head2;  
head2.next = new Node(4);  
head2.next.next = new Node(6);  
head2.next.next.next = new Node(8);
```

```
Node head3 = new Node(0);  
a[2] = head3;  
head3.next = new Node(9);  
head3.next.next = new Node(10);  
head3.next.next.next = new Node(11);
```

```
Node res = mergeKList(a, N);
```

```
if (res != null)  
    printList(res);  
System.out.println();
```

```
}
```

```
}
```

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