**Heap Sort**

Given an array of size N. The task is to sort the array elements by completing functions **heapify**() and **buildHeap**() which are used to implement Heap Sort.

**Example 1:**

**Input:**

N = 5

arr[] = {4,1,3,9,7}

**Output:**

1 3 4 7 9

**Explanation:**

After sorting elements

using heap sort, elements will be

in order as 1,3,4,7,9.

**Example 2:**

**Input:**

N = 10

arr[] = {10,9,8,7,6,5,4,3,2,1}

**Output:**

1 2 3 4 5 6 7 8 9 10

**Explanation:**

After sorting elements

using heap sort, elements will be

in order as 1, 2,3,4,5,6,7,8,9,10.

**Expected Time Complexity:** O(N \* Log(N)).  
**Expected Auxiliary Space:** O(1).

**Constraints:**  
1 ≤ N ≤ 106  
1 ≤ arr[i] ≤ 106

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### Java Code

//{ Driver Code Starts

import java.util.\*;

class Heap\_Sort

{

void printArray(int arr[],int n)

{

//int n = arr.length;

for (int i=0; i<n; ++i)

System.out.print(arr[i]+" ");

System.out.println();

}

public static void main(String args[])

{

Scanner sc = new Scanner(System.in);

Heap\_Sort hs = new Heap\_Sort();

int arr[] = new int[1000000];

int T = sc.nextInt();

while(T>0)

{

int n = sc.nextInt();

for(int i=0;i<n;i++)

arr[i] = sc.nextInt();

Solution ob=new Solution();

ob.heapSort(arr,n);

hs.printArray(arr,n);

T--;

}

}

}

// } Driver Code Ends

class Solution

{

//Function to build a Heap from array.

void buildHeap(int arr[], int n)

{

for(int i=n/2-1; i>=0;i--){

heapify(arr, n, i);

}

}

//Heapify function to maintain heap property.

void heapify(int arr[], int n, int i)

{

int leftchild=i\*2+1;

int rightchild=i\*2+2;

int largest=i;

if(leftchild<n && arr[leftchild]>arr[largest]){

largest=leftchild;

}

if(rightchild<n && arr[rightchild]>arr[largest]){

largest=rightchild;

}

if(i!=largest){

swap(arr , i, largest);

heapify(arr, n, largest );

}

}

//Function to sort an array using Heap Sort.

public void heapSort(int arr[], int n)

{

buildHeap(arr, n);

for(int i=n-1;i>0;i--){

swap(arr, 0, i);

heapify(arr, i, 0);

}

}

public void swap(int[] arr, int i, int j){

int temp=arr[i];

arr[i]=arr[j];

arr[j]=temp;

}

}