

Lab Report

Course Code: **CSE135**

# Course Name: Data Structure Lab

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Lab No: **11**

**Submitted to**

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**Questions:**

1. **Construct an (i) Max Heap and (ii) Min Heap.**
2. **Implementation of Heap Sort Algorithm**

**Code: (Github Link: https://github.com/shefat2002/DS\_LAB/blob/main/Lab\_11.cpp)**

**#include <bits/stdc++.h>**

**using namespace std;**

**#define nl cout << "\n";**

**#define ll long long;**

**void heapify\_maxheap(int a[], int n, int i)**

**{**

**int mx = i;**

**int l = 2\*i +1;**

**int r = 2\*i +2;**

**if(l < n && a[l] > a[mx]){**

**mx = l;**

**}**

**if(r < n && a[r] > a[mx]){**

**mx = r;**

**}**

**if(mx != i){**

**swap(a[i] , a[mx]);**

**heapify\_maxheap(a, n, mx);**

**}**

**}**

**void MaxHeap(int a[], int n)**

**{**

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

**heapify\_maxheap(a, n ,i);**

**}**

**}**

**void heapify\_minheap(int a[], int n, int i)**

**{**

**int mn = i;**

**int l = 2\*i +1;**

**int r = 2\*i +2;**

**if(l < n && a[l] < a[mn]){**

**mn = l;**

**}**

**if(r < n && a[r] < a[mn]){**

**mn = r;**

**}**

**if(mn != i){**

**swap(a[i] , a[mn]);**

**heapify\_minheap(a, n, mn);**

**}**

**}**

**void MinHeap(int a[], int n)**

**{**

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

**heapify\_minheap(a, n ,i);**

**}**

**}**

**int find(int a[] ,int n, int x)**

**{**

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

**if(a[i] == x) return i;**

**}**

**return -1;**

**}**

**void heapSort(int a[] , int n)**

**{**

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

**heapify\_maxheap(a, n , i);**

**}**

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

**swap(a[0], a[i]);**

**heapify\_maxheap(a,i,0);**

**}**

**}**

**int main()**

**{**

**int a[] = {1,2,3,15,7,8,21,11,5,16,19,9};**

**int n = sizeof(a)/sizeof(a[0]);**

**/\***

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

**cout << a[i] << ' ';**

**}**

**nl;**

**\*/**

**MaxHeap(a,n);**

**cout << "Max Heap:";nl;**

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

**cout << a[i] << ' ';**

**}**

**nl;nl;**

**MinHeap(a,n);**

**cout << "Min Heap:";nl;**

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

**cout << a[i] << ' ';**

**}**

**nl;nl;**

**/\***

**cout << "Enter a value to insert: ";**

**int x; cin >> x;**

**a[n] = x;**

**n++;**

**MaxHeap(a,n);**

**cout << "After insertion :";nl;**

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

**cout << a[i] << ' ';**

**}**

**nl;**

**cout << "Enter a value to delete: ";**

**cin >> x;**

**int pos = find(a,n, x);**

**a[pos] = a[n-1];**

**n--;**

**MaxHeap(a,n);**

**cout << "After Deletion :";nl;**

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

**cout << a[i] << ' ';**

**}**

**nl;**

**\*/**

**heapSort(a,n);**

**cout << "Heap Sort:";nl;**

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

**cout << a[i] << ' ';**

**}**

**nl;**

**return 0;**

**}**

**Sample Input & Output:**

**Max Heap:**

**21 19 9 15 16 8 3 11 5 2 7 1**

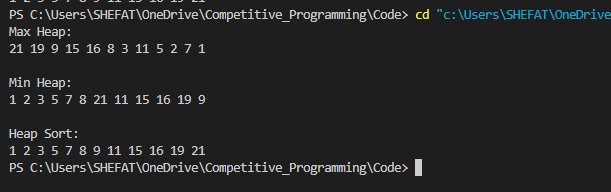
**Min Heap:**

**1 2 3 5 7 8 21 11 15 16 19 9**

**Heap Sort:**

**1 2 3 5 7 8 9 11 15 16 19 21**

**Screenshots:**



GitHub: github.com/shefat2002