COMSATS UNIVERSITY ISLAMABAD

Attock Campus

Department Of Computer Science

Course	Data Structures
Instructor	Sir Muhammad Kamran
Assignment No	03
Program	BS-(SE)
Semester	04

Submitted By:

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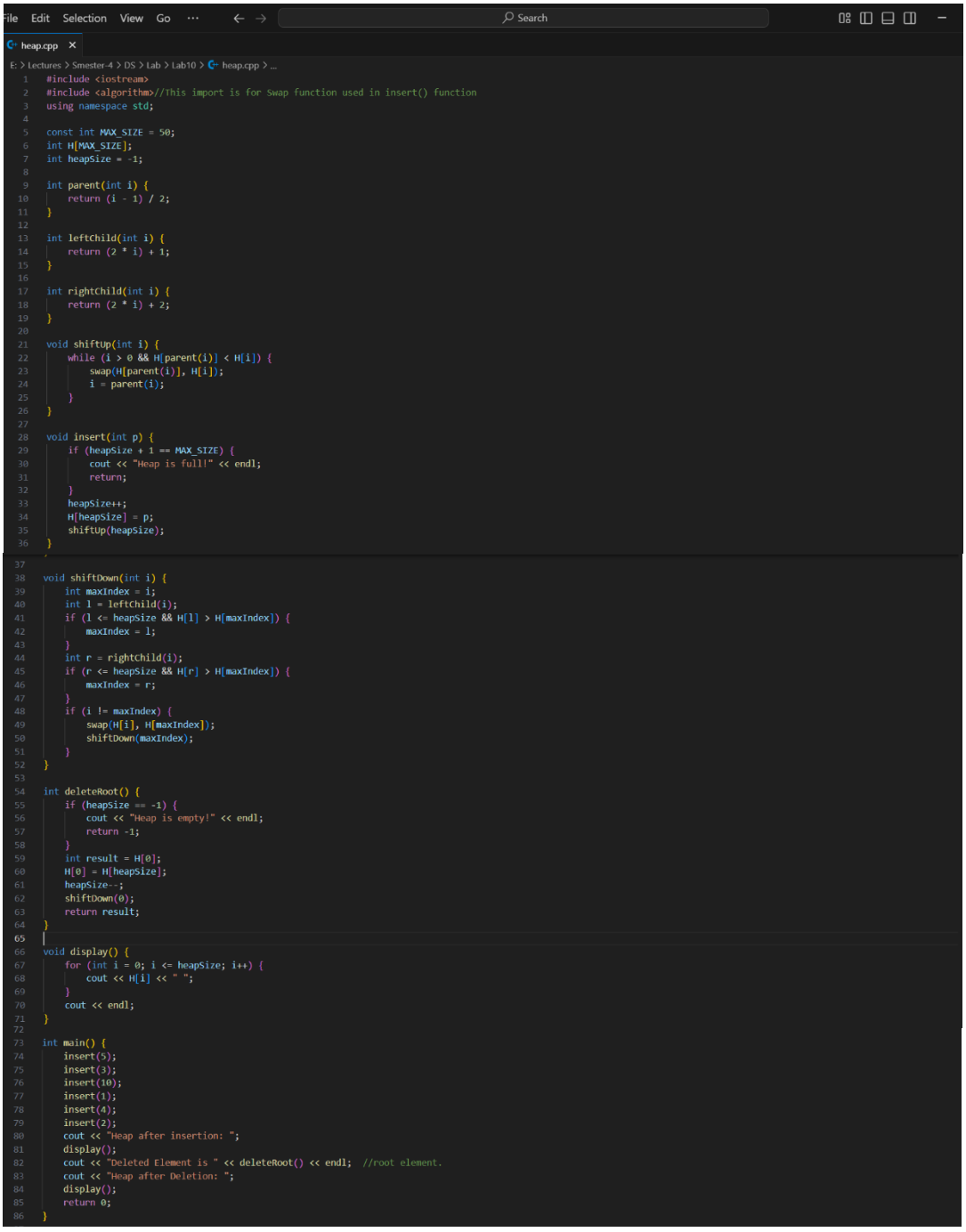
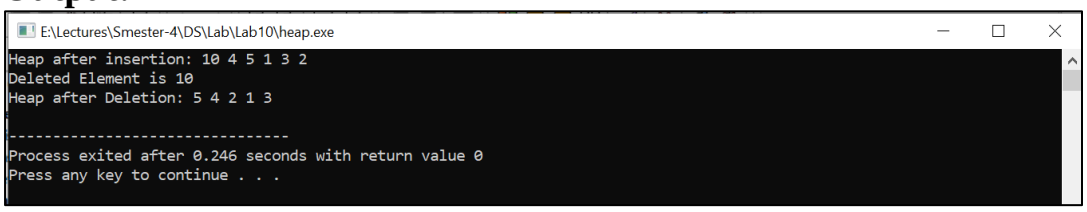
Heap Implementation

Code:



```cpp
#include <iostream>
#include <algorithm>//This import is for Swap function used in insert() function
using namespace std;

const int MAX_SIZE = 50;
int H[MAX_SIZE];
int heapSize = -1;

int parent(int i) {
    return (i - 1) / 2;
}

int leftChild(int i) {
    return (2 * i) + 1;
}

int rightChild(int i) {
    return (2 * i) + 2;
}

void shiftUp(int i) {
    while (i > 0 && H[parent(i)] < H[i]) {
        swap(H[parent(i)], H[i]);
        i = parent(i);
    }
}

void insert(int p) {
    if (heapSize + 1 == MAX_SIZE) {
        cout << "Heap is full!" << endl;
        return;
    }
    heapSize++;
    H[heapSize] = p;
    shiftUp(heapSize);
}

void shiftDown(int i) {
    int maxIndex = i;
    int l = leftChild(i);
    if (l <= heapSize && H[l] > H[maxIndex]) {
        maxIndex = l;
    }
    int r = rightChild(i);
    if (r <= heapSize && H[r] > H[maxIndex]) {
        maxIndex = r;
    }
    if (i != maxIndex) {
        swap(H[i], H[maxIndex]);
        shiftDown(maxIndex);
    }
}

int deleteRoot() {
    if (heapSize == -1) {
        cout << "Heap is empty!" << endl;
        return -1;
    }
    int result = H[0];
    H[0] = H[heapSize];
    heapSize--;
    shiftDown(0);
    return result;
}

void display() {
    for (int i = 0; i <= heapSize; i++) {
        cout << H[i] << " ";
    }
    cout << endl;
}

int main() {
    insert(5);
    insert(3);
    insert(10);
    insert(1);
    insert(4);
    insert(2);
    cout << "Heap after insertion: ";
    display();
    cout << "Deleted Element is " << deleteRoot() << endl;  //root element.
    cout << "Heap after Deletion: ";
    display();
    return 0;
}
```

Output:



```
E:\Lectures\Smester-4\DS\Lab\Lab10\heap.exe
Heap after insertion: 10 4 5 1 3 2
Deleted Element is 10
Heap after Deletion: 5 4 2 1 3

--------------------------------
Process exited after 0.246 seconds with return value 0
Press any key to continue . . .
```