ASSIGNMENT NO.16 (MAX HEAP):

```cpp
#include <iostream>
#include <vector>

using namespace std;

void heapify(vector<int>& arr, int n, int i) {
    int largest = i;
    int left = 2 * i + 1;
    int right = 2 * i + 2;

    if (left < n && arr[left] > arr[largest]) {
        largest = left;
    }

    if (right < n && arr[right] > arr[largest]) {
        largest = right;
    }

    if (largest != i) {
        swap(arr[i], arr[largest]);
        heapify(arr, n, largest);
    }
}

void heapSort(vector<int>& arr) {
    int n = arr.size();

    // Build max heap
    for (int i = n / 2 - 1; i >= 0; i--) {
```

```cpp
        heapify(arr, n, i);
    }

    // Extract elements from the heap one by one
    for (int i = n - 1; i > 0; i--) {
        swap(arr[0], arr[i]);
        heapify(arr, i, 0);
    }
}

int main() {
    // Input array
    vector<int> arr = {12, 11, 13, 5, 6, 7};

    cout << "Original array: ";
    for (int num : arr) {
        cout << num << " ";
    }
    cout << endl;

    // Perform Heap Sort
    heapSort(arr);

    cout << "Sorted array: ";
    for (int num : arr) {
        cout << num << " ";
    }
    cout << endl;

    return 0;
}
```

ASSIGNMENT NO.17 (MIN HEAP):

```cpp
#include <iostream>
#include <vector>

using namespace std;

void heapify(vector<int>& arr, int n, int i) {
    int smallest = i;
    int left = 2 * i + 1;
    int right = 2 * i + 2;

    if (left < n && arr[left] < arr[smallest])
        smallest = left;

    if (right < n && arr[right] < arr[smallest])
        smallest = right;

    if (smallest != i) {
        swap(arr[i], arr[smallest]);
        heapify(arr, n, smallest);
    }
}

void buildHeap(vector<int>& arr) {
    int n = arr.size();
    for (int i = n / 2 - 1; i >= 0; i--) {
        heapify(arr, n, i);
    }
}
```

```cpp
void heapSort(vector<int>& arr) {
    int n = arr.size();

    // Build max heap
    buildHeap(arr);

    // Extract elements from heap in decreasing order
    for (int i = n - 1; i > 0; i--) {
        swap(arr[0], arr[i]);
        heapify(arr, i, 0);
    }
}

int main() {
    vector<int> arr = {12, 11, 13, 5, 6, 7};
    int n = arr.size();

    cout << "Original array: ";
    for (int i = 0; i < n; i++) {
        cout << arr[i] << " ";
    }
    cout << endl;

    heapSort(arr);

    cout << "Sorted array: ";
    for (int i = 0; i < n; i++) {
        cout << arr[i] << " ";
    }
    cout << endl;
```

```
    return 0;

}
```