The Heap Sorter

Assignment:
For this week's assignment, you're going to be creating a Heap Sorter. It should be able to take input (using CIN), place it into proper Max Heap form in an array, and once it's done accepting input, put the array in order using a Heap Sort. For the sake of simplicity, our heap trees will be made of an array that's only seven elements long. Make sure to define your arrays ahead of time with garbage filler data before you start putting in your CIN data.
Remember to use the binary heap traversal trick shown in lecture when dealing with your array-based tree.
Please sort the following lists of inputs:

1.) 12, 40, 2, 6, 88, 90, 5
2.) 1, 2, 3, 4, 5, 6, 7
3.) 7, 6, 5, 4, 3, 2, 1
4.) 42, 64, 355, 113, 101, 13, 35
5.) 12, -5, 24, -4, 48, -3, 96

(100 pts total: 50 points for code, 10 points for each result.)

Code:

```
// Name: Dawlat Hamad
// ID: GV5450
// Lab 11 - The Heap Sort
// Source 1: https://cseweb.ucsd.edu/classes/wi05/cse101/impl1.pdf
// Source 2: https://www.youtube.com/watch?v=MtQL_ll5KhQ

#include <iostream>
using namespace std;

void heap(int arr[], int n, int i)
{
   // Parent, Left child, Right child formulas
   int largest = i;
   int left = 2 * i + 1;
   int right = 2 * i + 2;

   // When left is larger than parent swap
   if (left < n && arr[left] > arr[largest])
   {
     largest = left;
   }
   // When Right is larger than parent swap
   if (right < n && arr[right] > arr[largest])
   {
     largest = right;
   }
```

```
    // Swap when parent isn't the largest
    if (largest != i)
    {
      swap(arr[i], arr[largest]);
      heap(arr, n, largest);
    }
}

void Sort(int arr[], int n)
{
    // Build max heap
    for (int i = n / 2 - 1; i >= 0; i--)
    {
      heap(arr, n, i);
    }
    for (int i = n - 1; i >= 0; i--)
    {
      swap(arr[0], arr[i]);
      heap(arr, i, 0);
    }
  }

int main()
{
    // Declare Variables
    int arr[7];
    int n = sizeof(arr) / sizeof(arr[0]);
    int i;

    // Prompt for Input
    cout << endl;
    cout << "This program will sort given list (max 7) of data and sort through Max Heap
Sort." << endl;
    cout << "Enter the list: ";
    for (i = 0; i < 7; i++)
    {
        cin >> arr[i];
    }

    // Max Heap Sort
    Sort(arr, n);

    //Print Output
    cout << "Sorted array is: ";
    for (int i = 0; i < n; ++i)
    {
```

```
        cout << arr[i] << " ";
    }
    cout << endl;
    cout << endl;
    return 0;
}
```

Output:

```
This program will sort given list (max 7) of data and sort through Max Heap Sort.
Enter the list: 12 40 2 6 88 90 5
Sorted array is: 2 5 6 12 40 88 90

This program will sort given list (max 7) of data and sort through Max Heap Sort.
Enter the list: 1 2 3 4 5 6 7
Sorted array is: 1 2 3 4 5 6 7

This program will sort given list (max 7) of data and sort through Max Heap Sort.
Enter the list: 7 6 5 4 3 2 1
Sorted array is: 1 2 3 4 5 6 7

This program will sort given list (max 7) of data and sort through Max Heap Sort.
Enter the list: 42 64 355 113 101 13 35
Sorted array is: 13 35 42 64 101 113 355

This program will sort given list (max 7) of data and sort through Max Heap Sort.
Enter the list: 12 -5 24 -4 48 -3 96
Sorted array is: -5 -4 -3 12 24 48 96
```