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Q.1

## Heap Sort without heapify

```
#include <iostream>
```

```
using namespace std;
```

```
void buildMaxHeap(int arr[], int n) {
```

```
    for (int i = 1; i < n; i++) {
```

```
        if (arr[i] > arr[(i-1)/2]) {
```

```
            int j = 1;
```

```
            while (arr[j] > arr[(j-1)/2]) {
```

```
                swap(arr[j], arr[(j-1)/2]);
```

```
                j = (j-1)/2;
```

```
            }
```

```
        }
```

```
}
```

```
void heapSort(int arr[], int n) {
```

```
    buildMaxHeap(arr, n);
```

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

```
        swap(arr[0], arr[i]);
```

```
        int j = 0, index;
```

```
        do {
```

```
            index = (2*j + 1);
```

```
            if (arr[index] < arr[index+1] && index < (i-1)) {
```

```
                index++;
```

```
            }
```

→



```
if (arr[i] < arr[index] && index < i) {  
    swap(arr[i], arr[index]);  
}
```

```
}
```

```
i = index;
```

```
while (index < i);
```

```
}
```

```
}
```

```
int main() {
```

```
    int arr[] = {10, 20, 15, 17, 9, 21};
```

```
    int n = sizeof(arr) / sizeof(arr[0]);
```

```
    heapsort(arr, n);
```

```
    printf("Sorted array : ");
```

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

```
        printf("%d ", arr[i]);
```

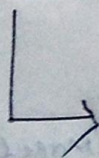
```
    }
```

```
    printf("\n");
```

```
    return 0;
```

```
}
```

Console Output



Sorted array: 9 10 15 17 20 21.



# Heap Sort with Heapify

```
#include <iostream>
```

```
using namespace std;
```

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

```
    int largest = i;
```

```
    int L = 2 * i + 1;
```

```
    int R = 2 * i + 2;
```

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

```
        largest = L;
```

```
    }
```

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

```
        largest = R;
```

```
    }
```

```
    if (largest != i) {
```

```
        swap(arr[i], arr[largest]);
```

```
        heapify(arr, n, largest);
```

```
    }
```

```
}
```





```

void heapSort (int arr[], int n) {
    for (int i = n/2 - 1; i >= 0; i--) {
        heapify (arr, n, i);
    }
    for (int i = n - 1; i > 0; i--) {
        swap (arr[0], arr[i]);
        heapify (arr, i, 0);
    }
}

```

```

int main() {
    int arr[] = {12, 11, 13, 5, 6, 7};
    int n = sizeof(arr) / sizeof(arr[0]);
    heapSort (arr, n);
    printf ("Sorted array: ");
    for (int i = 0; i < n; i++) {
        printf ("%d", arr[i]);
    }
    printf ("\n");
    return 0;
}

```

Console Output

↳ Sorted array: 5 6 7 11 12 13

*Shirish*  
*Datta*