Example of Heapsort Algorithm

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Example of Heapsort algorithm.

NOTIFICATION: These examples are provided for educational purposes. Using this code is under your own responsibility and risk. The code is given 'as is'. I do not take responsibilities of how they are used.

heapsort.c:

```
/* Framework for the sorting programs.
 * Program: 02
 * Author: Alejandro G. Carlstein
 * Description: This program will read a set of integers from standard
 * input and sort them by implement a heap sort using the pseudocode
 * from the book Introduction to Algorithms' by Thomas H. Cormen.
 * Then print them out in sorted order (smallest to largest).
 */

#include <stdio.h>

#define MAX_SIZE 1000000
#define LEFT(i) ((i << 1) + 1)
#define RIGHT(i) ((i << 1) + 2)
#define DIV_BY_2(i) (i >> 1)

void Max_heapify(int array[], int i, int heap_size);
void Build_max_heap(int array[], int heap_size);
void Exchange(int *a, int *b);
void Heapsort(int array[], int length);

int data[MAX_SIZE];
int n;

int main(int argc, char* argv[]){

 int i;
 int heap_size;

 /* Read in the data */
 n = 0;
    while (scanf('%d', &data[n]) == 1)
     ++n;

 /* Sort the numbers low to high */
 Heapsort(data, n);
```

```
 /* Print out the data */
 for (i = 0; i < n; ++i)
     printf('%d\n', data[i]);

 return 0;
}

/*
 * Max_heapify helps to rebuild the heap region
 */
void Max_heapify(int array[], int i, int heap_size){

 int l, r, temp, largest;

 l = LEFT(i);

 r = RIGHT(i);

 // Find Largest value
 largest = (l < heap_size && array[l] > array[i]) ? l : i;

 if (r < heap_size && array[r] > array[largest]) largest = r;

 if (largest != i){

  // Exchange
  Exchange(&array[i], &array[largest]);

  // Rebuild heap region
  Max_heapify(array, largest, heap_size);

 }// end if

}

/*
 * Build_max_heap helps to build the initial heap
 */
void Build_max_heap(int array[], int heap_size){

 int i = DIV_BY_2(heap_size);

 for (; i > -1; i--){

  Max_heapify(array, i, heap_size);

 }//end for

}

/*
 * Exchange swap the values holded by two variables
```

```
 */
void Exchange(int *a, int *b){

  int temp;

  temp = *a;
  *a = *b;
  *b = temp;
}

/*
 * Heapsort sort an array from the smallest element to the largest
 */
void Heapsort(int array[], int length){

 int i;
 int heap_size = length ;

 Build_max_heap(data, length);

 for (i = (length - 1) ; i > 0; --i){

  // Exchange the largest item in the heap region
  // to the beginning of the sorted region
  Exchange(&data[0], &data[i]);

  // Reduce the heap region, increase the sorted region
  heap_size--;

  // Rebuild the heap region
  Max_heapify(data, 0, heap_size);

 }//end for

}
```

If you encounter any problems or errors, please let me know by providing an example of the code, input, output, and an explanation. Thanks.