Algorithms 2023-24

Degree in Computer Science Engineering

Practical 3: Heaps

Submission deadline: Saturday, 11 November

1. Implement the following operations on **min heaps**.

```
#define SZ 256000
struct heap {
  int last;
  int vector[SZ];
};

typedef struct heap * pheap;

void create_heap(int a [], int n, pheap h);
int remove_min(pheap h);
```

   Validate that the three above operations work correctly.

   Note: since arrays in C are indexed starting with zero, the relative positions of the children and parent of a node in the array have to be recalculated with respect to the ones seen in the theoretical lessons.

2. Show empirically that creating a heap from any given array with n elements (operation `create_heap`) runs in time $O(n)$.

3. Implement *heap sort*: `void heap_sort(int a [], int n)`

```
procedure Heap sort (var A[1..n])
  create_heap (A, H);
  for i := 1 to n do
    A[i] := remove_min(H);
  end for
end procedure
```

   Validate that the sorting algorithm works correctly.

4. Empirically calculate the complexity of the sorting algorithm for three different initial scenarios: (a) the array is already sorted in ascending order, (b) the array is already sorted in descending order, and (c) the array is initially unsorted.

5. Submit the C code files and the `.txt` file with the report using the task *Practical 3 Submission* at the Algorithms page in `https://campusvirtual.udc.gal`. We remind you that the deadline to complete the task is on Saturday, 11 November, at 23:59, and once submitted, files cannot be changed. **All the students in a team must submit the work.**