

## Exercise #1

Subject: Sorting algorithms

Requirements: Knowledge of the operation of the following algorithms:

- Insertion sort - IS
- Selection sort – SS
- Bubble sort - BS
- Heap sort - HS
- Quick sort - QS
- Merge sort MS
- Shell sort -ShS
- Counting sort – CS

Knowledge of the computational complexity of the above algorithms, their at worst, average and best case.

### Exercise

I.1. Compare the speed of 4 sorting methods: BS, HS, CS, ShS for the array of integers randomly generated according to the uniform probability distribution.

Submit a chart  $t=f(n)$  where:  $t$  - sorting time;  $n$  - number of elements of the sequence. The number of elements must be selected in such a way that measurements can be taken properly. The results are presented in one chart (at least 15 measuring points).

2. Formulate conclusions on the computational complexity of the methods studied and their relationship with the efficiency of sorting and the memory activities of each method.

II.1. For different input types compare the effectiveness of 3 sorting algorithms.

a) QS with middle selected pivot, b) HS and c) MS. Examine the performance for the following data types of the sequence:

- random (uniform distribution)
- constant value (e.g. equal to 0)
- increasing order (step equal to 1)
- descending order (step equal to 1)
- ascending-descending order (A shape – increase odd numbers - decrease even)
- descending-ascending order (V -shape – decrease odd numbers - increase even)

Prepare charts  $t=f(n)$  where:  $t$  - sorting time;  $n$  - number of array elements for different data types (2 consecutive types per chart - 6 characteristics).

The number of elements must be selected in such a way that measurements can be taken properly.

1. The results are presented in charts - one for two data types (at least 15 measuring points).

2. Draw conclusions on the computational complexity and computational efficiency of QS execution and the behavior of the algorithm in the worst case scenario and for the different types of data. What is the median effect on QS sorting time? What is it used for?

( 2 weeks)