Assignment No. 5 **Assignment Title:** Linear time sorting

Part A:

An array **A** of **n** elements $(e_1, e_2, ..., e_n)$ and and two integers **j** and **k** $(1 \le j \le k \le n)$ are given. For each element e_i in **A**, we know that $j \le e_i \le k$.

Your **first task** is to write a function that takes the number of elements (**n**), **j** and **k** as input, and generates such an array of n elements and returns it.

Hint: You can use in-built random functions (rand() and srand() in C) see link

Part B:

Your **second task** is to write a function that takes the randomly generated array from part A and sorts the array in linear time (i.e. in O(n)) and prints the sorted values.

Hint: Check the topics covered in the DAA theory webpage.

Part C: [Bonus]

Consider a situation when there is no constraints on the value of **j** and **k** except for $\mathbf{j} < \mathbf{k}$, and $\mathbf{n} << (\mathbf{k} - \mathbf{j})$. You can assume that the elements of the array A are distributed uniformly randomly. With this assumption, your third task is to sort the array in (expected) linear time using linear amount of memory.

Hint: If you divide the interval k-j into n (nearly) equal sub-intervals, then you can expect that each sub-interval will contain exactly one element of the array, since the elements are distributed uniformly randomly.