

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

**Part A:**

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

Your **first task** is to write a function that takes the number of elements 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  $j < k$ , and  $n \ll (k - j)$ . You can assume that the elements of the array **A** is 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.*