

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.