Lab 4.1

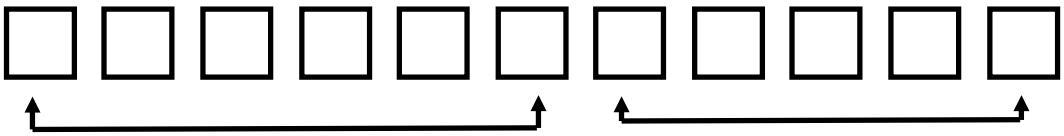
Write a C program that generates randomly **n** numbers, and stores them in a binary file.
Give **n**, and the output filename as arguments in the command line.

Lab 4.2

Then, write a concurrent C program that sorts the content of a binary file generated by the previous program, **mapped in memory.**
The filename is given as argument in the command line.
Sorting is performed by using a number of threads, **`nthreads`**, that depends on the file length.
In particular, the number of threads is computed according to this formula:

`nthreads = ceiling(log10(number_of_integers_in_file)`.

Each thread sorts the numbers in separate regions of the file, swapping adjacent numbers until no more swaps are necessary because the number in the region are sorted.
Then, one of the threads controls if it is necessary to swap the adjacent numbers at the boundary of two adjacent regions.
In the example shown in figure, the file contains **`11`** numbers, thus **`nthreads=2`**.
The first thread sort a region that contains **`6`** numbers, the second thread sorts a region that contains **`5`** numbers.
Only one of them must check if a swap is necessary at the boundary of the two adjacent regions.



If a file contains **`101`** numbers the main must create **`3`** threads, thus the regions are **`3`**, with 33,33,35 numbers, respectively, and the adjacent boundaries are 2.

The main thread creates all threads and then terminates.

Synchronize the threads, so that all checking threads run only after the sorting threads have sorted the numbers in their region.
Notice that, if a swap occurs, the sorting threads must sort again their region.
This process continues until no checking threads performs a swap. Then, the threads terminate.

Create a compressed **`tgz`** archive file with this syntax:

Lab <LAB_number>_<Your_Id_number>_<YourLastname>. tgz

Example:

`Lab04_123456_Smith.tgz`

which includes all the source programs, and if necessary the input data, for each assignment.

For example: **`Lab4-123456_Smith.tgz`** must include **`Lab4.1.c`, Lab4.2.c and a description of your solution**.

Drop your **`tgz file`** in the folder **Elaborati** of the SDP site of Portale della didattica.