Issued Date : Wednesday, May 25 2022 **Due Date :** Monday, June 6 2022

Special instructions : Must be done in teams of 8 people

Objective

The objective of this assignment is to compare how two different programming languages can solve a given problem.

Problem statement

You have to implement a **merge sort** on **singly linked lists** using two different programming languages and two distinct concurrent accesses for a total of 4 programs. One of the programming languages must be Java, and the second one is the same as for assignment 1.

In order to achieve better comparison and testing of the programs, each implemented algorithm must read from a file the list of integer elements to fill 4 distinct linked lists. The first list will contain the even and prime numbers, the second list will contain the even and unprime numbers, the third list will contain odd and prime numbers, and the fourth list will contain odd and unprime numbers. At this phase, the 4 linked lists do not need to be sorted and they are populated in the order of the input file. Once the 4 linked lists are filled, the program must apply merge sort on each and generate 4 distinct sorted output files. As for the previous assignments you must produce statistics such as the execution time, the memory usage, the number of loops, etc.

The first two programs will use **single-threading** and the other two programs will use **multi-threading**. With multi-threading you will need to implement 4 concurrent threads and each thread will sort a specific singly linked list.

Relationship with term paper

Each programming assignment should be done from the perspective of the comparative study to be made in the term paper. In the term paper, you will be asked to provide a comparative description of each of the programming languages you have used in your assignments. From the perspective of this assignment, you should be able to compare the performance of the sorting singly linked lists using single-threading and multi-threading.

Assignment submission requirements and procedure

You have to submit your assignment before midnight on the due date on moodle as "*programming assignment 3*". Late assignments are not accepted.
The file submitted must be a **.zip** file containing:

- all your code (i.e. 4 different programs) in text (i.e. source) format and in executable format,
- one input file containing data to be read by the programs,
- Outtput files for each program containing the relevant statistics (i.e. total time to populate the unsorted linked lists, total time to sort the linked lists, the memory usage for the merge sort

operation, the number of iteration done by the merge sort operation in each program, and the total execution speed),

- and instructions on how to compile and execute all your programs in a README file.

Evaluation Criteria

- Correctness of implementations (10 pts).
- Input and output files (4 pts).
- Output of relevant statistics enabling comparison (6 pts).