laSalle
UNIVERSITAT RAMON LLULL

2023 - 2024 Academic year
Distributed Systems
Submission deadline: 4th of October 2023

EXERCISE 1: QUESTIONNAIRE ABOUT THREADS AND CONCURRENCY

Learning Objectives
By the end of this exercise, you should be able to:

- Understand shared memory vs shared nothing models.

Exercise statement

1. Explain what are the *advantages* and *disadvantages* of parallel programming paradigm (shared memory) has in front of the distributed programming paradigm (shared nothing).

2. Describe three types of real world applications of parallel programming and three types of real world applications of distributed programming.

3. Write a class in Java that allows two threads to do a parallel search of an integer inside a LinkedList. Specifically, one thread must start searching at the beginning of the LinkedList and the other at the end. In the end of the execution, it must be reported which of the two threads found the number first (if it's present).

4. Write Java class that allows a parallel search of an integer inside an array. Specifically, the class gives this method:

   ```
   1 | public static int ParallelSearch(int toSearch, int[] Array, int NumThreads)
   ```

   This method creates as many threads as specified by **NumThreads**, divides the array into as many parts as NumThreads, and gives (copy) to each thread the part of the array that corresponds to it to do a sequential search of the value **toSearch**. If a thread has found the value, the method will return the box in the initial array and will display its thread number. Otherwise, the method will return -1.

5. Modify the previous exercise so that the threads access the array via shared memory. Compare the search time with the previous exercise and justify the differences. Experiment with different array sizes and number of threads.

6. Justify the difference between using the *run* method and the *start* method of the *Thread* class.

7. Write a multithreaded program in Java that sorts an array recursively using merge sort. So, the main thread creates 2 threads and each creates two new threads to sort half of the array.

8. Compare the execution time of the previous exercise with a sequential arrangement. Justify the results.