Assignment 1 Preliminary Specification 2024

This is a preliminary specification for the first assignment. Its purpose is to give you an overview of what is required, so that you can think about it in general terms and plan your approach to solving the problem. Full details will follow shortly.

Objective:

Your objective for this assignment is to write two MPI programs. But for now, think in general terms about how you might solve the problem, such as by experimenting with pseudocode for each variant, as in Question 1 of Workshop 2. This will give you a chance to think about, and analyse, the message-passing operations that you will need to achieve the objective, before beginning the process of writing MPI code. Remember that you are working in an SPMD framework, meaning that you write a single program that executes simultaneously on all processes.

Background

Each program comprises a total of **five processes**. Each process contains a number. Your objective is to find numbers out of order, and print information about them.

The number in a process is said to be out of order if it is less than the number in its left neighbour. The ordering starts at process 0 (process 0 has no left neighbour).

For example, if processes 0 through to 4 contain, respectively, the numbers 5, 7, 9, 1 and 13, then the number 1 in rank 3 is out of order. All the others are in order.

Process 0	Process 1	Process 2	Process 3	Process 4
5	7	9	1	13

Assignment requirements:

1. The first program

In the first program, the processes are completely independent, and there is no master process. Each process independently determines whether it is out of order with respect to its left neighbour's number.

Output:

- If a process has a number that is out of order, it should print: "Process <rank> has number <n> out of order."
- It then prints an indication that it has terminated: "Process <rank> has finished."

2. The second program

In the second program, process 0 will act as a master. The task is similar to the first program, which is to identify processes that are out of order. The desired output from this program is one line for each process that contains a number out of order with its left neighbour, in the same format as above. However, in this case, the lines must appear in order of rank. The final line to be printed is:

Output:

- For each out-of-order process, the following line should be printed: "Process <rank> has number <n> out of order." In addition, the lines must appear in order rank.
- The final line to be printed is: "The number of processes holding an out-of-order number is <n>."

Assessment and Deadline

The deadline is the end of Week 6.

The assignment will be assessed based on the programs themselves, and a report. Further details of assessment criteria, precise deadlines, and how to submit assignments, will follow shortly.