This exercise is based on the Lamport's paper[1] on logical clocks in a distributed system.

1. List the members of your group below. Underline your name.

2. What is the key characteristic distinguishing a distributed system from a non-distributed one, when both are composed of a collection of concurrent hardware and software processes?

3. Define a partial order. Give examples of a total order, a non-total partial order, and an ordering relation that is neither.

[1] Leslie Lamport, "Time, Clocks and the Ordering of Events in a Distributed System," *Communications of the ACM* 21/7 (1978).

4. Provide a small, *concrete* example of events in a system exhibiting all the cases noted in the definition of the *happened before* relation $\rightarrow$, as well as the case of concurrent events. Use space-time diagrams as in the paper.

5. Augment your example of Question 4 to include logical clocks. Assume all logical clocks are initialized to the same value and increment them only as necessary to preserve the clock condition.

6. Using a suitable space-time diagram, explain why the mutual-exclusion problem defined in the paper cannot be correctly solved by using a central scheduling process.

7. Explain how the mutual exclusion algorithm described in the paper handles the scenario of Question 6. Include details on messages and data structures used by the algorithm.