EXERCISE 1:

1. Global States for the Execution

The figure above shows events occurring for each of two processes, $p_1$ and $p_2$. Arrows between processes denote message transmission. Draw and label the lattice of consistent states ($p_1$ state, $p_2$ state), beginning with the initial state $(0, 0)$.

2. Synchronous System

You are running a collection of processes $p_1, p_2, ..., p_N$. Each process $p_i$ contains a variable $v_i$. You wish to determine whether all the variables $v_1, v_2, ..., v_N$ were ever equal in the course of the execution.

   a) Your processes run in a synchronous system, meaning there are known bounds on the drift rate of the local clocks, message transmission time and execution time for each step of a process.

   You use a monitor process to determine whether the variables were ever equal. When should the application processes communicate with the monitor process, and what should their messages contain?

   b) Explain the statement $\text{possibly}(v_1 = v_2 = \ldots = v_N)$. How can you determine whether this statement is true of your execution?