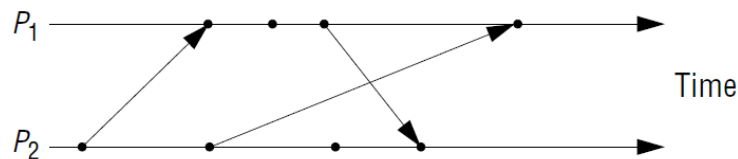


Exercise for the lecture  
**Distributed Systems**  
 Summer 2014  
 Sheet 1

**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  $p_1, p_2, \dots, p_N$ . Each process  $p_i$  contains a variable  $v_i$ . You wish to determine whether all the variables  $v_1, v_2, \dots, v_N$  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  $possibly(v_1 = v_2 = \dots = v_N)$ . How can you determine whether this statement is true of your execution?