Distributed Algorithmics – TD2 -
M2 IFI, Ubinet-CSSR, English version

Exercice 1

1. What do the events p5, q1, p2, r4 represent ?
2. Looking at the diagram, can you tell if communication channels are FIFO or not ?
3. Looking at the diagram, can we have:
    a. A sending of a message at q5 and its reception at p2' ? (assuming q5 and p2' are the events for this sending and reception, thus replacing those events actually shown on the diagram)
    b. A sending of message at p3' and its reception at q3' ?
4. Apply Lamport clocks, initially at 0 on each process. What are the clock values on P after p6, on Q after q11, on R after r6 ?
5. Give the minimum value of the whole execution. Assume that communication delay on a channel is bounded by Tau_max
6. What are the events that cannot be compared (i.e. concurrent) to q6, according to the causality relation
7. Show that is 2 events a and b are such that clock(a) < clock(b), we do not necessarily have that a precedes b according to the causality relation

Exercice 2

We consider the temporal diagram (see figure 1), associated to the execution of a distributed algorithm involving 3 processes, P1, P2, P3 and the events a1, b1, c1, d1 on P1, a2, b2, c2, d2 on P2, a3, b3, c3 on P3.

1. Do you think that the way the diagram is depicted relies on the atomic model (introduced in the Mattern paper) ?
2. Compute Lamport clock values for each of the events. Timestamp accordingly the messages exchanged
3. Compute the Vector clock values (vectors with 3 values) for each of the events
4. Comment the values of the vectors that timestamp the events c1 and c3
5. Tell how events b3 and c2 are timestamped using Lamport clocks, and using these clocks tell if you can or not compare b3 and c2 according to the causality ("happened-before') relation.
   Do the same but using vector clocks.
   Do again question 5, but on events b3 and d2.
6. Describe in terms of events, the cuts (more precisely, the frontiers of the cuts) C, C', C''. Are these cuts consistent ?
7. Given ri, the number of messages received by Pi, and si the number of messages sent by Pi, for a cut C. Compute the sum over i of si = S and the sum over i of ri = R, for each cut C, C', C''.
8. Do the values obtained by the cut C'' enable you to conclude that the algorithm is terminated. ?