Session 2: Exercises

M2 MOSIG: Distributed Systems

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1 Lamport clocks

Question 1.1: *Show through an example that Lamport Clocks cannot be used to decide whether a cut is consistent.*

2 Vector Clocks

Question 2.2: *Consider an execution in which the events are time stamped using vector clocks. Define a function $\mathcal{F}$ which takes the vector clock of an event e and convert it to a scalar value SC, so that $e \rightarrow e' \Rightarrow SC(e) < SC(e')$. Prove that your function $\mathcal{F}$ ensures the targeted property.*

Question 2.3: *Let C be a consistent cut defined by the tuple $(c_1, c_2, .., c_n)$. Let $VC(e_i^{c_i})$ be the vector clock of event $e_i^{c_i}$. What condition, expressed in terms of $VC(e_i^{c_i})$, ensures that C is consistent?*

3 Back to Chandy-Lamport algorithm

Question 3.4: *Recall that the Chandy-Lamport snapshot algorithm requires FIFO-channels to work. Modify the algorithm to also work without that assumption.* ***NB*** *Consider only a single instance of the algorithm.*

Propose an algorithm that only computes a consistent global state (it does not save the state of the channels).
Note : *Do not implement FIFO order of messages.*
Hint: *Use piggybacking (piggyback the adquate information on application messages).*

Question 3.5: *Extend your algorithm to also record the state of the channels.*