The University of Melbourne
School of Computing and Information Systems
COMP90020 Distributed Algorithms

Tutorial Week 4: Global States

Notes

An event is called *presnapshot* if it occurs at a process before the local snapshot at that process is taken; otherwise it is called *postsnapshot*. A snapshot is consistent if

- (1) no postsnapshop event is causally before a presnapshot event
- (2) a basic message is included in a channel state if and only if the corresponding send event is presnapshot while the corresponding receive event is postsnapshot.

Exercises

15. Consider the following figure:

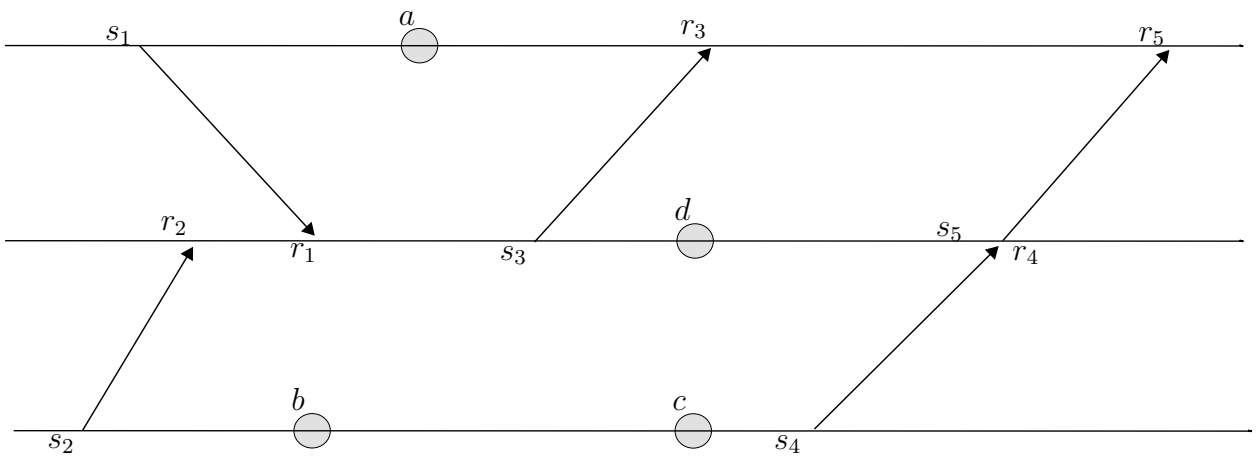

Figure 1: Three process sequence diagram

(a) Provide the vector timestamps at each send, receive and concurrent event.

(b) Provide an example of a consistent and inconsistent cut.

16. Consider the following: Two processes P and Q are connected in a ring using two channels, and they constantly rotate a message m. At any one time, there is only one copy of m in the system. Each process's state consists of the number of times it has received m, and P sends m first. At a certain point, P has the message and its state is 102. Immediately after sending m, P initiates the chandy-lamport snapshot algorithm. Explain the operation of the algorithm in this case, giving the possible global state(s) reported by it.

17. Consider the following figure

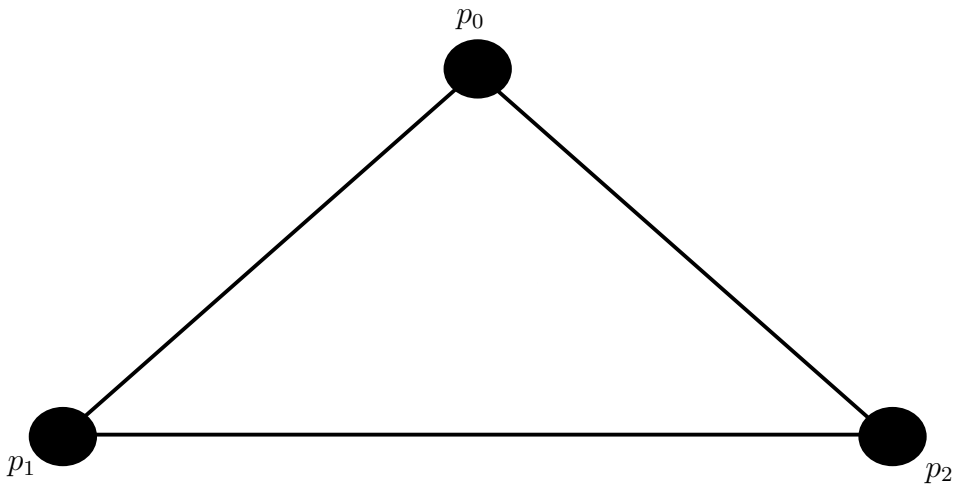

Figure 2: Channel complete communication with three processors

In the above system, each process calculates it's next message it will send, using the first message that exists in it's buffer as follows.

$$next(msg_i) = \begin{cases} \frac{msg_i}{2} & msg_i \bmod 2 = 0 \\ 3 \cdot msg_i + 1, & msg_i \bmod 2 = 1 \end{cases}$$

Likewise, each process m decides which corresponding neigbour k to send this message to as follows:

$$target(msg_i, m) = \begin{cases} (m+1) \bmod 3 & msg_i \bmod 2 = 0 \\ (m-1) \bmod 3, & msg_i \bmod 2 = 1 \end{cases}$$

Assume each node holds no local state, only processing it's buffer in a FIFO manner. Initially, each node has it's buffer contain a single value:

$$p_0 = \{11\}, p_1 = \{10\}, p_2 = \{9\}$$

(a) After some sequence of messages, each nodes buffer is as follows: $p_0 : \{\}, p_1 : \{\} p_2 : \{\{34\}\{5, 14\}\{\}\}$. Is this a possible (globally consistent) state?

(b) Assume in the above scenario, process p_0 initiates the chandy-lamport snapshot algorithm. Explain the operation of the algorithm in this case, giving the possible global state(s) reported by it.