

## Exercise 5

### 1 Reliable Broadcast with FIFO Links

An implementation of FIFO Reliable Broadcast (RBC) has been given in Section 5.5.2. Assume that the point-to-point links between all servers are FIFO, that is, messages are delivered by the link in the order they were sent (the links in the handout are not assumed to be FIFO). Does the RBC protocol (Algorithm 13) implement FIFO broadcast? Justify your answer.

### 2 Atomic Broadcast with FIFO and Causal Ordering

Algorithm 20 in the handout implements atomic broadcast (ABC) given a primitive for consensus and a primitive for reliable broadcast (RBC).

- a) Show that replacing RBC with Causal RBC does not implement Causal ABC.
- b) Show that layering the FIFO and Causal Broadcast protocols (Algorithms 15 and 17, respectively) on top of Algorithm 20 implements Causal ABC. This establishes the two arrows on the right in the figure in Section 5.5.5, and completes the proof for the layered approach used in the handout.