

## Exercise 5

### 1 Perfect Failure Detector

- a) Assume that a bound  $\Delta$  on message delay is known and holds always. Design a perfect failure detector  $\mathcal{D} \in \mathcal{P}$ .
- b) Assume that a bound  $\Delta$  on message delay exists, but is not known to the protocol designer, and that the bound holds only after some “global stabilization time”  $t_\Delta$ . Design an eventually perfect failure detector  $\mathcal{D} \in \diamond\mathcal{P}$ .

### 2 Non-Blocking Atomic Commit

The reduction of non-blocking atomic commit in Section 5.4 uses a perfect failure detector. Does it also work with an eventually perfect failure detector? Why or why not?

### 3 Efficient Causal Broadcast

Algorithm 17 (in Section 5.5.3) for causal broadcast from FIFO broadcast suffers from impractically large messages, which grow in proportion to the number messages sent by a party. Provide a more efficient implementation directly using reliable broadcast. (Use a vector clock for causal ordering.)