Exercise 9

1 Flooding Uniform Consensus

Can we optimize Algorithm 5.3 [CGR11] (Flooding Uniform Consensus) to save one or more communication rounds? More preicsely, can it be modified such that all correct processes always decide after $N - 1$ or fewer rounds? (Consider a system of two processes only.)

2 Total-Order Broadcast with FIFO and Causal Ordering

Algorithm 6.1 [CGR11] implements total-order broadcast given a primitive for consensus and a primitive for reliable broadcast.

a) Show that replacing the reliable broadcast primitive with a causal broadcast primitive does *not* implement causal total-order broadcast.

b) Consider the FIFO-order broadcast implementation in Algorithm 3.12 [CGR11, p. 102] "Broadcast with Sequence Number". It is built from a reliable broadcast primitive. Show that replacing the reliable broadcast primitive with a total-order broadcast primitive (Module 6.1 [CGR11]) realizes a total-order broadcast primitive that respects FIFO delivery.

c) Similarly, consider the causal-order broadcast implementation in Algorithm 3.24 [CGR11, p. 132], "No-Waiting Causal Broadcast". It is built from a FIFO-order reliable broadcast primitive. Show that replacing the underlying FIFO-order reliable broadcast with a FIFO- and total-order broadcast primitive realizes a total-order broadcast primitive that respects causal delivery.