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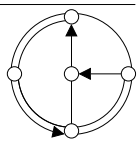

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Principles of Distributed Computing
Exercise 6

Synchrony assumptions are usually specified in terms of a bound Π on the relative execution speed of the servers and a bound Δ on the time for message transmission on a link. Here we assume that local operations take *no* time and ignore Π.

1 Failure Detectors

a) Assume that a bound Δ on message delay is known and holds always. Design a perfect failure detector $\mathcal{D} \in \mathcal{P}$.

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

2 Timed Reliable Broadcast

Given an external observer capable of measuring real time, a *[real-time] D-timed reliable broadcast* is a reliable broadcast that satisfies:

D-Timeliness: If a message m is broadcast at real time t, then then *no* correct server delivers m after real time $t + D$.

Consider a synchronous network where up to f servers may crash and every two correct servers are linked by a path of length at most d consisting only of correct servers. Show that Algorithm 8.15 implements D-timed reliable broadcast with $D = (f + d)\Delta$.