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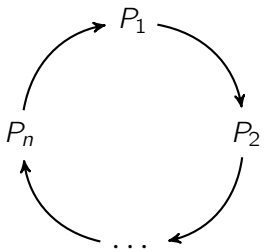
– Assignment 5 –

Exercise 1 (3 points)

Consider the following leader election protocol: For $n \in \mathbb{N}$, n processes $P_1, \ldots, P_n$ are located in a ring topology where each process is connected by an unidirectional channel to its neighbor as illustrated on the right figure. To distinguish the processes, each process is assigned a unique identifier $id \in \{1, \ldots, n\}$. The aim is to elect the process with the highest identifier as the leader within the ring.



Give a CFM implementation for the leader election protocol aforementioned.

Exercise 2 (3 points)

In the lecture, we have introduced the CFM (cf. Lecture 8 slides p. 8-9) with *perfect* channels (i.e. messages stored in the channel will never get lost). In this exercise, we consider a modified CFM with *lossy* channels. We assume the channels between processes are unreliable, hence can lose messages during the transmission.
For example, in the lossy channel CFM, the second message `req` stored in channel $(1, 2)$ (cf. Lecture 8 slide p. 10) shown in the left part of following figure can be lost and results in a configuration as shown in the right part of the following figure.

Give a formal semantics of the *lossy channel* CFM mentioned above.

Exercise 3 (4 points)

Prove that whether a deadlock-free CFM is $\forall B$-bounded for a given bound $B > 0$ is decidable.