

FDS : Exercise 8

1 Leader Election in an “Almost Anonymous” Ring

1. Is deterministic leader election possible in a synchronous ring in which all but one processors have the same identifier? Either give an algorithm or prove an impossibility result.
2. Is deterministic leader election possible in a synchronous ring in which all but two processors have the same identifier? Either give an algorithm or prove an impossibility result.

2 Distributed Computation of the AND

Consider an anonymous ring where each processor has a single bit as input. You can assume that nodes can distinguish between their neighbors, i.e., when a node v receives a message, v knows which neighbor has sent the message (note that nodes may not know a consistent clockwise or counterclockwise orientation of the ring!).

1. Prove that there is no uniform synchronous algorithm for computing the AND of all input bits.
2. Present an asynchronous (non-uniform) algorithm for computing the AND; the algorithm should send $O(n^2)$ messages in the worst case.
3. Present a synchronous (non-uniform) algorithm for computing the AND; the algorithm should send $O(n)$ messages in the worst case. What is the time complexity of your algorithm?