Principles of Distributed Computing
Exercise 2

1 Leader Election in an "Almost Anonymous" Ring

a) Is 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 Distributed Computation of the AND

Consider an anonymous ring where processors start with binary inputs. 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.

a) Prove that there is no uniform synchronous algorithm for computing the AND of the input bits.

b) Present an asynchronous (non-uniform) algorithm for computing the AND; the algorithm should send $O(n^2)$ messages in the worst case.

c) Present a synchronous algorithm for computing the AND; the algorithm should send $O(n)$ messages in the worst case. What is the time complexity of your algorithm?