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?