

Homework Exercise #6

Due: 11:30 a.m., October 29, 2014

1. Consider an asynchronous shared-memory system where any number of processes may experience halting failures.

An m -valued conflict detector has two operations:

- m -ANNOUNCE(v) (where $v \in \{0, 1, \dots, m - 1\}$) returns *ack*, and
- m -DETECT returns true if two *different* values have previously been announced and false otherwise.

(a) Give a formal sequential specification of an m -valued conflict detector.

- (b) Let $k = \lceil \log_2 m \rceil$. Suppose you have 2-valued conflict detectors C_0, C_1, \dots, C_{k-1} . Is the following implementation of an m -valued conflict detector correct (i.e., linearizable)? Prove your answer is correct.

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m-ANNOUNCE( $v$ )
  let  $v_{k-1}v_{k-2} \dots v_1v_0$  be the binary representation of  $v$ 
  for  $i \leftarrow 0..k - 1$ 
     $C_i$ .2-ANNOUNCE( $v_i$ )
  end for
end m-ANNOUNCE

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m-DETECT
  for  $i \leftarrow 0..k - 1$ 
    if  $C_i$ .2-DETECT then return true
  end for
  return false
end m-DETECT

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Hint: try to put the linearization point of each m -DETECT operation at the beginning or end of its execution interval (i.e., when it is invoked or when it returns).