Name:_____

Quiz 5 Fall 2016 Distributed Algorithms 20 points 20 minutes

1. (6 points) Consider vector consensus for n processes with d dimensional inputs, in a synchronous system.

   (a) State true or false: When d>1, vector consensus can be achieved by performing consensus separately on each dimension of the input. _____

   (b) Suppose that n = 4 and d = 2. Suppose that the inputs at 3 non-faulty processes are (1,1), (2,1) and (1,2), and the remaining process is faulty.

   For each output below, specify whether it will satisfy the *validity* condition:

   (i) (1.5, 1) _____

   (ii) (2, 2) _____

2. (6 points) State True or False:

   (i) With Ben-Or's algorithm, each non-faulty process always decides its output within 2^n phases, where n is the number of processes. _____

   (ii) With Ben-Or's algorithm, when two processes decide the output, their decision values are *exactly* equal. _____

   (iii) With Ben-Or's algorithm, the decision value chosen by any process is always the input of some process. _____

3. (8 points)

   (a) Consider two processes P1 and P2, each with a 4-bit input. It is known that the input of process P1 is either 0000 or 1111. The input of process P2 may equal any of the 16 possible 4-bit values.

   What is the least number of bits of communication necessary for P1 to determine whether its input equals the input of P2? _____

   (b) Consider 10 processes P1, P2, …, P10 each with a k-bit input that can take any of the 2^k possible values. Assume that k > 100. Suppose that the given processes are connected by a broadcast channel. When a message is sent over the broadcast channel by any process, all the processes receive it.

   By transmitting at most 2k bits on the broadcast channel, can all the processes determine whether their inputs are equal? _____