

Homework 2: Membership

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1

Given that there are at most two failures at a time in the system, which of the following protocols does NOT satisfy completeness?

- Ring-style heartbeating where each process heartbeats to only its clockwise neighbor
- Gossip-style heartbeating
- Ring-style heartbeating where each process heartbeats to both its clockwise neighbor and anticlockwise neighbor
- All-to-all heartbeating

2

In a datacenter with 10,000 machines, the MTTF (mean time to failure) of a single server is 48 months. You can assume each month has 30 days. The MTTF (mean time to failure) until the next server fails in the data center is approximately:

- About 3.4 hours
- About 2.5 hours
- About 3.4 minutes
- About 2.5 days

3

Someone designs a new failure detector where processes are organized in a binary tree. In a binary tree, there is one node (process) at the root (level 1), which has 2 children (nodes or processes) at level 2, which in turn each have 2 children at level 3, and so on. If node A is a child of node B, then B is a parent of A (and vice-versa). In this heartbeat protocol, every process sends heartbeats to its parent in the tree. Heartbeats are not relayed or gossiped. This protocol is:

- Accurate
- Neither complete nor accurate
- Complete

4

A startup in your home garage is designing a new gossip-style failure detection similar to that discussed in lecture. In this new protocol, at a node (process or server) A, at local time = 140, its local entry for a node C is (address, counter, time) = (C, 340, 133). $T_{fail} = 40$. A receives a gossip message from node B containing one heartbeat as (sender-id, heartbeat counter), as shown below. For each case below, indicate what the new updated heartbeat at A for C should be in parentheses, i.e., like "(C, 340, 133)".

- (C, 349), A: (C, 349, 140)
(C, 123), A: (C, 340, 133)
(C, 60), A: (C, 340, 133)
(C, 355), A: (C, 355, 140)
- (C, 349), A: (C, 349, 141)
(C, 123), A: (C, 355, 133)
(C, 60), A: (C, 355, 133)
(C, 355), A: (C, 355, 140)
- (C, 349), A: (C, 349, 133)
(C, 123), A: (C, 340, 133)
(C, 60), A: (C, 340, 140)
(C, 355), A: (C, 355, 140)
- (C, 349), A: (C, 349, 133)
(C, 123), A: (C, 340, 133)
(C, 60), A: (C, 340, 133)
(C, 355), A: (C, 355, 133)

5

In a heartbeat protocol for failure detection, increasing the timeout (used for declaring a member as failed), without changing any other protocol parameter, results in which of the following? (Select multiple correct answers.)

- Increases false positive rate
- Decreases false positive rate
- Decrease in bandwidth
- Increases detection time