

Computer Science 171
Quiz 3, May 18, 2009
Spring 2009

1. Suppose that the underlying infrastructure provides causal multicast primitive for group communication. Is it possible to use this primitive to take a consistent snapshot of a system? Give a simple algorithm and briefly argue why inconsistency cannot arise (i.e., a message is received at the destination but is not sent from the source). If it is not possible, give an example where in spite of the causal multicast – the snapshot is inconsistent.
2. You are asked to implement a distributed mutual exclusion among a set of processes to synchronize accesses to a shared resource. You are given a choice of any of the group communication primitive: reliable multicast, causal multicast, and atomic multicast. Which one of the group communication primitive you will choose to implement mutual exclusion in distributed system? Give reasons for your choice.
3. Suppose that two causal multicast groups have overlapping members. Does this type of overlap gives rise to the problem of non-causal delivery for the processes that are in the intersection. Give an example of this problem.
4. Show that the following containment relationship between causally ordered and totally ordered multicasts:
 - Show that a causally ordered multicast need not be a total order multicast.
 - Show that a total ordered multicast need not be a causal order multicast (or argue otherwise).
5. Give a formal definition of Byzantine Agreement problem, i.e., state the initial condition and three requirements: Agreement, Validity, and Termination.
6. Give a formal definition of the Consensus problem, i.e., state the initial condition and three requirements: Agreement, Validity, and Termination.
7. We discuss a consensus algorithm for crash failures in a synchronous system that can handle up to $f < n$ failures, where n is the total number of processes. What is the maximum number of rounds that will be needed to reach consensus if there are f failures? Give arguments to support your answer.