Politecnico di Milano – V Facoltà di Ingegneria

089081 e 075274 - Sistemi distribuiti (Ord. 270 e Ord. 509)

Prof. G. Cugola – September 21, 2011

Rules:

- **You are not allowed to use books, notes, or other material.**
- **You can answer in Italian or English.**
- **Total time for the test: 2 hours.**

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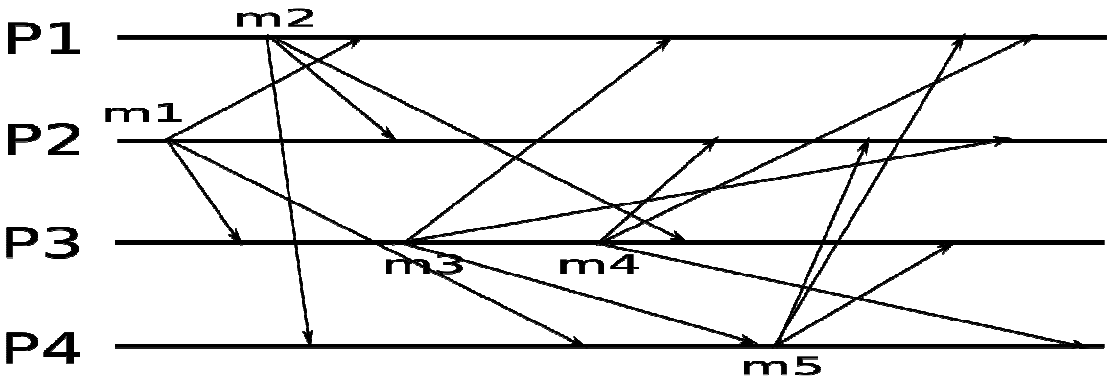
1. Implement a `SyncStrIntMap` class in Java. It takes a `Map<String, Integer>` (supposed to be non thread safe) at creation time and implements a thread save version of the map. It provides the usual `get`, `put`, `remove`, `containsKey`, and `size` methods. The first three methods suspend the caller if the passed key has not an associated value (methods `get` and `remove`) or if it has already one (method `put`).

2. Write the vector clock values for the situation in figure. At the end of the execution, by only looking at its own vector clock, what can P3 say about the messages it sent (i.e., who received them)?



3. Describe how to use scalar clocks to guarantee mutual exclusion in accessing a resource in a fully distributed way.

4. You want to write a reliable data store by replicating the basic data store functionalieties among many processes. If you suppose that such processes may fail silently, how many of them you need to guarantee k-fault tolerance? Why? What if you assume byzantine failures?

5. Consider the following schedule (notice that it contains two different variables, X and Y)

P0:	W(X)1	R(X)3	R(Y)1
P1:	W(Y)1	R(X)1	W(Y)2
P2:	R(Y)2	W(X)3	
P3:	R(Y)1	R(Y)2	R(X)1

a) Do NOT consider process P3. Is the schedule composed of processes P0, P1, and P2 consistent with a sequential / causal / FIFO consistency model?
In the case it is not consistent with the sequential model, is it possible to make it consistent by removing a SINGLE operation?

b) Consider also process P3. Is the schedule composed of processes P0, P1, P2, and P3 consistent with a sequential / causal / FIFO consistency model?
In the case it is not consistent with the sequential model, is it possible to make it consistent by removing a SINGLE operation?

Motivate your answers.

6. Consider the following P2P architectures for filesharing applications:

a) Centralized Database (e.g. Napster)
b) Query Flooding (e.g. Gnutella)
c) Distributed Hash Table (e.g. Chord)

Describe and compare them focusing on the algorithms they adopt for joining the network, and for publishing, serching, and fetching files.

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