

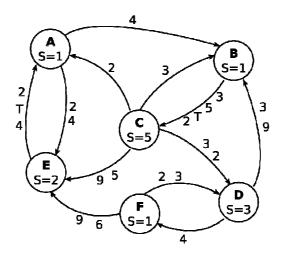
## Politecnico di Milano – V Facoltà di Ingegneria

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

Prof. G. Cugola - January 27, 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.
- 1. Implement a ReadWriteLock class in Java. The class offers three methods for locking: readLock to acquire the lock in read (non exclusive) mode, writeLock to acquire the lock in write (exclusive) mode, and unlock, to release the lock. More than one thread can hold the read lock simultaneously. At any given time, only one thread can hold the write lock, which can be granted only if no other thread is holding a read or write lock. A thread calling a readLock or writeLock when the lock cannot be granted is suspended until the lock is freed.
- 2. Consider the system in figure, which is running a distributed snapshot. Suppose that every process works by adding the value held by the received messages to its internal state S. Process A started the snapshot sending the token to processes B and E (already processed). Assuming that no other operations occur apart those required to end the snapshot, show the state captured by every node at the end of the snapshot (local state and messages recorded for each link).



- 3. Describe (i) what we mean by "naming system", (ii) the differences between a "flat" and a "structured" naming system, and (iii) how a name server can be distributed hierarchically in the two cases of a flat and a structured name system.
- 4. Describe how to use scalar clocks to obtain a totally ordered multicast communication primitive.

5. Consider the following schedule, where each operation is performed on a single variable x.

P0: W(1) R(2) W(3)

P1: R(1) W(2) P2: W(4) R(1)

P3: R(4) R(1) R(3) R(2)

a) Is the schedule consistent with respect to the following consistency models: FIFO, causal, sequential? Motivate your answers.

Now assume a weak consistency model is adopted; the synchronization variable is used as follows:

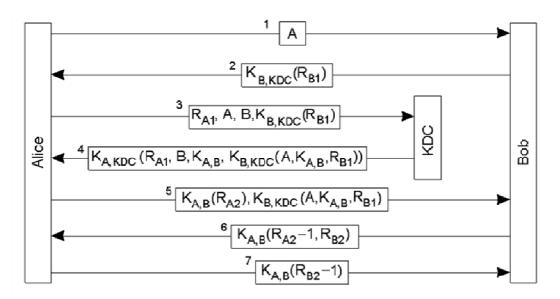
P0: W(1) R(2) W(3) S

P1: R(1) W(2) S

P2: W(4) R(1) S

P3: R(4) R(1) R(3) R(2) S

- b) Is the schedule consistent? Motivate your answer.
- 6. Consider the following protocol:



- a) Which problem does it solve?
- b) Why does the KDC put B inside message 4?
- c) Why does the KDC put R<sub>A1</sub> inside message 4?
- d) Why does the KDC put R<sub>B1</sub> inside message 4?