

Homework Assignment 5

ECE 151 / CMPSC 171 - Spring 2013

Due Monday, May 13

1. (a) Given the replicas in Lecture 8, Slide 7. What needs to be done to finalize the values in the **conit** so that A and B see the same result?

(b) Given the interleavings in Lecture 8, Slide 13. Is 001110 a valid result for a **sequentially consistent** data store? Explain why or why not.

2. Given four processes P1, P2, P3, P4 with the read and write operations shown in the examples below.

(a) Does the following example satisfy **sequential consistency**? Explain why or why not.

P1		R(y)b	R(x)c	R(x)a
P2	W(x)a	W(x)c		
P3			R(y)b	R(x)c
P4	W(y)b			

(b) Does the following example satisfy **causal consistency**? Explain why or why not.

P1	W(x)a		
P2		R(x)a	R(x)b
P3	R(x)a	W(x)b	
P4		R(x)b	R(x)a

3. (a) Given three processes P1, P2, P3, with the read, write, acquire and release operations shown in the examples below.

(a) Does the following example satisfy **release consistency**? Explain why or why not.

P1		Acq(L)	W(x)b	Rel(L)	
P2	Acq(L)	W(x)a	Rel(L)		
P3			R(x)a		Acq(L) R(x)a Rel(L)

(b) Does the following example satisfy **entry consistency**? Explain why or why not.

P1	Acq(L)	W(x)a	W(y)b	Rel(L)			
P2				Acq(L)	R(x)a	W(x)c	Rel(L)
P3						Acq(L)	R(x)a Rel(L) R(y)b

4. In the examples below, the operations are performed by a process on two different local copies (L1 and L2) of the same distributed data store. (See Lecture 9, Slides 5-13 for notation and examples.)

(a) Does the following example satisfy **read-your-writes consistency**? Explain why or why not.

L1	WS(x ₁)		WS(x ₃)
L2		WS(x ₂)	R(x ₂)

(b) Does the following example satisfy **writes-follow-reads consistency**? Explain why or why not.

L1		WS(x ₁ ,x ₂)	R(x ₂)
L2	R(x ₁)		WS(x ₁ ,x ₃)

5. A file is replicated on 12 servers using a quorum system. List all of the possible pairs of **write quorum** and corresponding minimal possible **read quorum**. For example, one possible (write quorum, read quorum) pair is (7,6).

6. (a) Explain the difference between a **primary-based remote-write** protocol and a **primary-based local-write** protocol, in terms of whether the data or the operations are sent from one server to another.

(b) In each case, explain when the data or the operations are sent from one server to another.