Homework Assignment 4
ECE 151 / CMPSC 171 - Spring 2014
Due Monday, April 28

Note: Problems 1 through 5 are due on Monday, April 28. Problem 6 (which is a Programming Assignment with a Demo) is due on or before Friday, May 9.

1. Consider the **Bully Election Algorithm**. (a) Is it necessary to assume reliable and timely delivery of messages? Explain why or why not. (b) Is it possible to elect two leaders, rather than just one? Explain why or why not.

2. A **Global Positioning System (GPS)** satellite broadcasts an accurate clock. (a) However, the clock received by a GPS receiver might not be so accurate. Explain why. (b) Nonetheless, some distributed applications still use a GPS clock. Give two examples of distributed applications that use a GPS clock.

3. (a) Given the replicas A and B 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 011111 a valid result for a **sequentially consistent** data store? If so, give an interleaving sequence. If not, explain why not.

4. Given four processes P1, P2, P3, P4 with the read and write operations shown in the example below. (a) Does the example satisfy **strict consistency**? Explain why or why not. (b) Does the example satisfy **sequential consistency**? Explain why or why not. (c) Does the example satisfy **causal consistency**? Explain why or why not. (d) Does the example satisfy **FIFO consistency**? Explain why or why not.

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

5. Given three processes P1, P2, P3 with the read, write, acquire and release operations shown in the example below. (a) Does the example satisfy **release consistency**? Explain why or why not. (b) Does the example satisfy **entry consistency**? Explain why or why not.

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

6. For this problem, you will implement the **Distributed Mutual Exclusion Algorithm of Ricart and Agrawal** in C/C++ using TCP sockets, or in Java using Java sockets.

You may work in groups of two for this problem. You will demonstrate your implementation of the algorithm to the TAs with $n = 3$ **processes** running on $n = 3$ **different computers**. The demos will take place on or before Friday, May 9. Please schedule a time for your demo with the TAs. At that time, you will also turn in your code and a short report, describing your program and how to run it.