22C: 166 Distributed Systems and Algorithms
Homework 5, Total points = 60

Assigned 11/27/12 due 12/4/12

Please submit typewritten solutions through ICON, preferably in the pdf format. Late assignments will not be accepted without prior approval. Remember that the burden of proving (or arguing) that your solution will work is on you, and not on the reader.

Question 1. (15+15 = 30 points) Earlier in the class, we have discussed algorithms for leader election. Now, consider the problem of leader election using *failure detectors* in a completely connected network of n processes, where up to f (f < n) processes can fail.

 (a) Solve the leader election problem using a *perfect* failure detector

(b) Solve the leader election problem using a *strong* failure detector

Question 2. (10 points) Different applications of group communication demand different types of ordered multicast. Consider the problem of maintaining a shared calendar of appointments by four different clerks, each having a separate copy of the calendar. A clerk will make an entry into his/her own copy of the shared calendar, and send it to the other three clerks. The requirement is that after any finite sequence of updates, all four copies of the calendars must be identical, and meaningful (thus if you first make an appointment at 10 AM on January 3, 2013 with one clerk, and then change it to 9 AM on January 4, 2013 with another clerk, then the last entry will prevail. In case of conflicts, (like two persons trying the make appointments for the same time slot), the second one will be rejected). What kind of ordered multicast will you recommend? Explain your answer.

Question 3. (15 + 5 = 20 points) Three processes 0, 1, 2 of a group communicate with one another, and the requirement is *causal order multicast*. A message from process 0 has a vector timestamp $(1, 2, 0)$, and it reaches node 2 when its local vector clock is $(0, 1, 2)$.

(a) Draw a diagram reconstructing the exchange of all the messages in the group.

(b) Will the message be accepted by process 2? Explain.