Assignment # 4

Deadline: Email the solution in pdf, and hand-in printout in class, Dec 3 (THU).

1. **(15 points)** Omission of any of the three requirements for the consensus algorithm (termination, agreement, validity) allows a very simple solution. Explain the statement by giving a solution for each case.

2. **(10 points)** Following is a different way of performing 2-phase commit. In this case, the participants communicate directly with one another instead of indirectly via the coordinator. In Phase 1, the coordinator sends its vote to all the participants. In Phase 2, if the coordinator's vote is No, the participants just abort the transaction; if it is Yes, each participant sends its vote to the coordinator and the other participants, each of which decides on the outcome according to the vote and carries it out. Calculate the number of messages and the number of rounds it takes. What are its advantages or disadvantages in comparison to the centralized variant studied in class?

3. **(5 points)** Explain how the 3-phase commit protocol avoids delay to participants during their uncertain period due to the failure of the coordinator or other participants. Assume that communication does not fail. (Uncertain period is the time when the participants cannot be sure of the final decision.)

4. **(10 points)** Why does the following algorithm not work for binary consensus under FLP assumptions? Give a scenario under which the algorithm fails. It is known that there are 6 processes in the system numbered P0 to P5. The algorithm is as follows: Every process sends its input bit in a message to all processes (including itself) and waits for five messages. Every process decides on the majority of the five bits received. (Hint: If you can provide an example where the algorithm fails, then that should suffice.)