**IS 651, Distributed Systems**

**Homework #4**

**100pts**

**Due Apr 17, 2020**

Q1.(30pts) What’s the difference between active replication and passive replication? What are the pros and cons of them?

Q2. (30pts) Revisit the motivating example we discuss in class. Explain why concurrency and failures are main challenges in distributed systems.

Q3. (40pts) Revisit the 2PC protocol we discussed with one coordinator and 3 participants, as illustrated below. The COMMIT messages could also be ABORT.



Q3A.(30pts) Consider the following scenarios where nodes may crash, explain the consequences. Under this scenario, assuming all the nodes can talk to each other, can the nodes safely abort or commit (i.e., all the correct nodes agree on either abort or commit)? Why?

1. A crashes and it does not send YES or NO to the coordinator.
2. C wants to send YES to the coordinator but it crashes before it sends the YES message.
3. Coordinator crashes after it sends ABORT to A (B and C do not receive ABORT from coordinator).
4. Coordinator crashes after it sends COMMIT to A and B (C do not receive COMMIT from coordinator).
5. Coordinator crashes before it sends any COMMIT or ABORT messages to A, B, or C.

A sample answer to a): Since the coordinator cannot receive YES or NO from all the nodes, the coordinator can send an ABORT message to all the nodes and they safely abort.

Q3B.(10pts) Give an example of a scenario where 2PC protocol does not terminate.