**IS 651, Distributed Systems**

**Homework #2**

**100pts**

**Q1.** (30pts) What’s the difference between caching and data replication? Is content delivery network a caching service or data replication service? Is data replication involved in CDN?

Cache – move a copy of the data at caching servers so that clients can access the data faster than directly obtaining them form the storage servers. There is usually a time window where the cached copy is out of date. Consistency is usually not a major concern.

Replication – replicate the data at a different place so as to avoid single point of failure. We usually want to make the copies consistent. The major purpose of replication is availability and reliability.

CDN is a caching service.

Replication in CDN can be used to provide availability (within CDN).

**Q2**. (50pts) Consider such a scenario: three students Alice, Bob, and Carol are working on the same report at three different places. They want to communicate and make sure they have a consistent view of the report. They have the following sequence of events ordered by real time.

* 1. Alice sends sync request to Bob
	2. Bob receives sync request from Alice
	3. Alice sends sync request to Carol
	4. Bob sends sync acknowledgment to Alice
	5. Bob sends sync request to Carol
	6. Carol receives sync request from Bob
	7. Alice receives sync acknowledgment from Bob
	8. Carol sends sync acknowledgment to Bob
	9. Carol receives sync request from Alice
	10. Bob receives sync acknowledgment from Carol
	11. Carol sends sync acknowledgment to Alice
	12. Alice receives sync acknowledgment from Carol
	13. Alice combines the results and sends the final report to Bob
	14. Alice sends final report to Carol
	15. Carol receives final report from Alice
	16. Bob receives final report from Alice

Questions: 1. (18pts) Draw the “happen-before” diagram for the events

* + 1. (32pts) Write out the Lamport clock representation of each timestamp, using the notation L([event]) = [Lamport Timestamp]. For example, L(e1)=1. You can also mark the timestamps on the diagram. If you want, you can explain your answer (one sentence or a simple equation, etc). Explanation will help you get partial credit even your answers are not correct.

