**IS 651, Distributed Systems**

**Homework #2 (100 pts)**

**Due Date: Mar 6, 2020**

Note: Please answer briefly the questions. Ideally, you don’t want to answer more than one page for each question. Also remember to cite the source for your answers.

**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?

**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.

**Q3.** (20pts) Based on the discussion so far, name one topic that you are interested in. If you are going to design an exercise based on the topic, what will be the question and the answer? (I’ll pick one of the questions from the submissions and include it in the midterm.)