Instructions:

Show all work. No electronic devices are allowed. This exam is open book, open notes. You have 100 minutes to complete the exam.

Please prepare your answers on separate sheets of paper. You may write your answers on the sheet of paper with the question (front and back). If you need more space, please attach a separate sheet of paper to the page with the particular question. Do NOT extend your answer on the back of the sheet for a different question, and do NOT use the same extra sheet of paper to answer more than one question. In particular, each numbered questions must appear on separate pieces of paper so that the exam can be split for grading. If you write part of your answer on the back of a page for another question, then the grader will not see the extra text for your answer and will not consider that part of your answer when assigning a grade.

Be sure to include your name and USC ID number on each page.

There are 100 points in all and 3 questions.

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1. (30 points) Matching

For each of the following techniques, methods, or systems, match the numbered method, technique, or system with the lettered characteristic. This is not a one-to-one mapping. So more than one method or system may match a characteristic, and a single method or system may also match more than one characteristic. We are looking for specific characteristics, for which you will receive credit. If you list what is a minor or redundant characteristic, while you will not lose credit, you will not get credit either. You will lose a point if you associated a method with a characteristic that does not apply to the method. There are more blanks in the page below than actual correct answers, so you do not need to fill in all the blanks.

1. Grapevine
2. Domain name system
3. Time Warp
4. Quorum Consensus
5. Locking
6. Message passing
7. RPC
8. ISIS
9. Kerberos

a) Is typically synchronous: _____ _____ _____ _____ _____
b) Uses Multi-level caching: _____ _____ _____ _____ _____
c) Is often unreliable: _____ _____ _____ _____ _____
d) Provides loose/eventual consistency: _____ _____ _____
e) Uses caching: _____ _____ _____ _____ _____
f) Uses replication: _____ _____ _____ _____ _____
g) Uses distribution: _____ _____ _____ _____ _____
h) An Optimistic Approach: _____ _____ _____ _____ _____
i) A Pessimistic Approach: _____ _____ _____ _____ _____
2. **(30 points) Synchronization**

For each of systems listed below, indicate whether updates are atomic, and why or why not. Note that it is acceptable for you answer to be that it depends on the implementation if there exist more than one way of implementing the system, but if you chose this option, be sure to indicate what about an implementation would determine if it is atomic or not. If updates in the system are atomic, identify the point of commitment, i.e. at what point does a change become permanent and visible to other processes.

(6 points each)

a) A transaction completed using two-phase commit:

b) Updates to names in Grapevine:

c) Updates to names in the domain name system:

d) Updates to file contents using Quorum Consensus (Weighted voting) for synchronization:

e) Transmission of messages using CBCAST:
3. **(40 points) Design Problem**

With the introduction of Google TV, it is expected that many more users will dump their cable or satellite systems, opting instead to view local channels over their air, and to subscribe to only those “added” channels they want, via the Internet. Users will subscribe to content from multiple providers, with subscription managed separately, instead of having subscriptions bundled through a single provider as has been the case traditionally for cable or satellite services. This more distributed model of content distribution will create many issues that need to be addressed.

a. Discuss the issues that need to be addressed in deploying such a system, including issues based on the volume of data to be managed, the fact that the content will be obtained from separately managed entities, and the problems of locating copies of the data. (15 points)

b. Explain how replication and caching might be used in such a system. In particular, focus on the placement of replicas and caches, and how the different “ownership” of content might affect the implementation of such techniques. (15 points)
c. Explain the requirements for naming in such a system. How might the system utilize existing naming system on the internet (e.g. the Domain Name System, and URL’s and other web focuses naming methods). Design an approach to resolving names in your system, both for locating the content associated with a particular television program, and for managing programs that may have been previously downloaded to a television or set top box (think of it like a DVR - Digital Video Recorder). (10 points)