Name: _____ **USC ID:** _____

CSci 555 Final Exam

Fall 2010

Instructions:

Show all work. No electronic devices are allowed. This exam is open book, open notes. You have **120 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 part of the answer to one of the questions (Q1, Q2, or Q3) is on a sheet of paper also used for one of the other questions, then that part of your answer might not be graded and you will NOT receive credit for that part of your answer.

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

There are **100 points** in all and **3 questions.**

	Q1	**Q2**	**Q3**	**Total**	**Letter**
Score					

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1. (30 points) Kernel / Hypervisors / Microkernel process architecture

   Compare Xen, Denali and Mach in terms of the protection boundaries that exist in the system. Which kernel and process functions reside within various protection boundaries that define the system. (By protection boundaries, you can assume that different rings, or system and user modes constitute distinct protection boundaries, and that at least different user level process similarly define distinct protection boundaries). Feel free to draw a diagram to illustrate you answer but it is still necessary to include a textual description of each boundary, and the functions provided.

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2. (30 points) File System Marching

For each of the following file systems, match the numbered system with the lettered characteristic. This is **not** a one-to-one mapping. So more than one 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 a less major 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 system. There are more blanks in the page below than actual correct answers, so you do not need to fill in all the blanks.

1. The Andrew File System II
2. The Sprite File System
3. Sun's Network File System
4. The Log Structure File System
5. RAID file systems
6. The LOCUS File System
7. Coda

a) Stateless: _____ _____ _____ _____ _____

b) Partitioned Operation: _____ _____ _____ _____ _____

c) Replicated Data: _____ _____ _____ _____ _____

d) Whole file caching: _____ _____ _____ _____ _____

e) Supports shared writes: _____ _____ _____ _____ _____

f) Callbacks: _____ _____ _____ _____ _____

g) Can improve write performance: _____ _____ _____ _____

h) Stateful: _____ _____ _____ _____ _____

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3. (40 points) Design Problem

You have been hired by the Southern California Power Department to design their next generation home energy power management system. This system will support the dissemination of current power pricing information to devices in the customer's home. It will also support the transmission of power usage data from the customer's power meter to the utility. For those users that subscribe to third party (web sites run by organizations other than the SCPD) power portals, selected usage data will be provided in real time to such third party sites, where it may be processed and presented to the user, or accessed by appliances at the customers' home for display or to make power management decisions.

a. Discuss in general terms the reliability and availability requirements of such a system. In particular, what would be the impact of loss of data, or delays in communicating control signals or data in such a system. The answer to this is likely to be different for different kinds of data, and for different control channels, so organizing your answer to this question in a table would be useful. Discuss some of the situations that could result in loss of such data, or inability to transmit control and information within the system.
(15 points)

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b. Improving reliability: Suggest techniques that you would use in the implementation of such a system to increase availability of the control and monitoring interfaces, and to reduce the likelihood that data would be lost (10 points).

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c. The system you are designing needs to be scalable. While initially to be deployed within Los Angeles County, the Department of Energy has imposed a requirement that the system be designed so that it is scalable nationwide. Discuss techniques you would employ in your design to ensure scalability. In particular, please focus on the registration and control of meters and devices within the home – with which entities in such a system would these devices communicate, and how will requirements for reduction of power demand caused by events such as the shutdown of a power plant in Arizona, for example, ultimately result in sufficient reduction in aggregate demand across the entire Western United States power grid. A diagram of your design showing the structure of the nationwide system would be helpful. (15 points).