You are only responsible for the materials discussed in class as they are summarized in the handouts and discussed in the PowerPoint presentations. I expect you to understand these summaries and to be able to comment around them. Always ask yourself why a specific technique was used and which problem it addressed.

Virtual Memory
- Focus on the authors’ choices for their reservation, fragment control, promotion, demotion and expulsion policies and skip the sections of the paper we did not discuss in class. Do not go into the details outside of Section 4.

Caching
- You can skip the theoretical developments that account for most of the paper but need to understand the algorithm as it is explained in:
  and the limitations of the other caching algorithms (including the tuning issue).

Kernel Issues
- Focus on the advantages and the limitations of the approach.

- Focus on the advantages and the limitations of the approach. Do not go into the details.

- You should understand the problem the authors want to solve and the way they implement their lightweight protection domains. Do not rely on the summary.

- We covered most aspects of the paper: skip the proof at the end.

- We covered most aspects of the paper: refer to the PowerPoint presentation.
Review questions

1. When do Navarro et al. suggest performing superpage speculative demotion? What is the purpose of this operation?

2. Explain why ARC is (a) scan-resistant and (b) self-tuning.

3. What distinguishes Corey processes from both regular kernel-supported threads and conventional UNIX processes?

4. Which of the following properties apply to these two approaches to kernel security?

<table>
<thead>
<tr>
<th>Property</th>
<th>PCC</th>
<th>Nooks</th>
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<tbody>
<tr>
<td>Allows extensions to be written in any programming language</td>
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<tr>
<td>Has a very low runtime overhead</td>
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<tr>
<td>Indirectly causes additional TLB misses</td>
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<td>Restarts extensions that crashed</td>
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<tr>
<td>Works with existing extensions</td>
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</table>

5. A system of physical clocks consists of two clocks, namely, one that is slow and loses 5 minutes every hour and another that is fast and advances by 5 minutes every hour. Assuming that the clocks are managed by Lamport’s physical clock protocol, what will be the time marked by each clock at 2:00 PM given that (a) both clocks indicated the correct time at noon; (b) the processors on which the clock reside continuously exchange messages between themselves; and (c) the message transmission delays are negligible.

6. Redo problem 3 assuming that the processors on which the two clocks reside stopped communicating with each other at one pm.

7. What does RAFT do to minimize the chances of split votes during leader elections?

Solutions: 1. The authors suggest speculatively demoting a superpage each time its page referenced bit is reset. The purpose of this operation is identifying which base pages of the superpage are still active. II. ARC is scan-resistant because data blocks coming from the files that are scanned will remain in list L-1 and the space T1 occupied by the top of this list will not increase during the scan because the scanned blocks in B1 will not be accessed a second time. ARC is self-tuning because it has no user-settable parameter. III. A Corey process can specify which parts of its address space are shared among sibling processes and which parts are not. IV. TF, TF, FT, FT, FT, V. Both clocks will mark two ten. VI. The fast clock will mark two ten and the slow clock will mark two. VII. It uses randomized timers so that different servers will detect the failure of their leader at different times.