University of the Saarland
Department 6.2 - Informatik
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Computer Architecture II - SS 04

(due: 30.09.2003)

Exercise 1: (Pagefault Handling) **(4 points)**

While handling pagefaults, the pager is sometimes forced to swap out pages. This is done in order to free space for the new page, which is swapped-in afterwards.
Describe in your own words why the most recently swapped-in page should not be evicted by the pager.

Exercise 2: (Control of the Memory Management Unit) **(3 + 2 + 3 points)**

In the paper 'Lecture Script on Memory Management Units'[1] you can find the control automaton of the memory management unit (p. 15, figure 10).

- Describe in your own words what states the control automaton traverses during a memory request from the processor side and what happens in those states. Do this
  1. for a translated write access without exceptions,
  2. for an untranslated read access without exceptions.
- What exceptions can occur during the address translation process and what are the possible reasons for the exceptions?

Exercise 3: (Correctness of Virtual Machine) **(6 + 8 points)**

In 'Lecture Script on Memory Management Units', the Step Lemma (Lemma 8, p. 29) was introduced. The proof of this lemma is given for the case, that I_V^j is not a load/store operation.
Prove the lemma for the case that I_V^j is a load operation. You can assume that there occurs no pff for I_V^j. So you have two cases in your proof:

- There occurs no page fault interrupt.
- There occurs a pfls interrupt.

Exercise 4: (Protection of the Interrupt Service Routine) **(4 points)**

The mode bit is only changed (from 1 to 0) as a side effect of a jump to the interrupt service routine. If a user program would be able to change the code of the interrupt service routine it would therefore be able to do arbitrary things. Describe two possible ways to protect the code of the interrupt service routine from being overwritten by a user level program.

[1] available on the web page:
http://www-wjp.cs.uni-sb.de/lehre/vorlesung/rechnerarchitektur2/ss04/literature/ca2mm.pdf