

# OHJ-4100 Operating Systems 17.5. 2010

Calculators, computers or literature are NOT allowed in this exam.

Johannes Koskinen will assess the exam.

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## 1. Question

Describe shortly (as to someone not familiar with this particular software systems subject) what these concepts are:

- a) What are the main functions of an operating system?
- b) Memory space
- c) Virtual address
- d) Swapping
- e) Process states READY, RUN, WAIT
- f) Privileged instruction

## 2. Question

What is a page replacement algorithm in paging memory systems? In what situations it is active and why? Explain either LRU (*Least Recently Used*) or DWS (*Denning Working Set*) algorithm by using an example.

## 3. Question

Which of the following operations must be prohibited when a user process is executing in the CPU (`USER_MODE == true`)? Why?

- a) Read from the memory region of the operating system
- b) Set the value of a timer-register (TIMER)
- c) Disable interrupts
- d) Enable interrupts
- e) Jump to execute code from the memory region of the operating system
- f) Execute CPU instruction WAIT, which stops the CPU and waits for a interrupt

## 4. Question

An ordinary user-mode process refers to memory location `0xDEADBEEF`. Explain how this virtual address is translated into a physical memory address when using paging virtual memory and

- a) a two-level page table (the 1st level or segment index and 2nd level page table index are 8 bits, offset is 16 bits wide), or
- b) inverse page tables (both page number and offset are 16 bits wide each).