Mittuniversitetet

MID SWEDEN UNIVERSITY

Final exam

DT011G Introduction to Operating Systems

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Instructions

Carefully read the questions before you start answering them. Note the time limit of the exam and plan your answers accordingly. Only answer the question, do not write about subjects remotely related to the question.

Write your answers on separate sheets, not on the exam paper. Only write on one side of the sheets. Start each question on a new sheet.

Make sure you write your answers clearly, if I cannot read an answer the answer will be awarded no points – even if the answer is correct. The questions are *not* sorted by difficulty.

Note that your answers for this exam does *not* have to include references to relevant literature.

Time 5 hours.

Aids Dictionary, course literature [SGG09, SGG13a, SGG13b], graded assignments, personal notes, and a calculator. The student may use the following e-book reader: TrekStor eBook-reader 3.0.

Maximum points 21

Questions 4

Preliminary grades

The following grading criteria applies: E $\geq$ 50%, D $\geq$ 60%, C $\geq$ 70%, B $\geq$ 80%, A $\geq$ 90%; with no question awarded zero points.

Aim

The aim of the exam is to examine that you have fulfilled the requirements specified in the course syllabus.

An operating system saga,
or: The exam questions

1. It's an early Monday morning, you've just arrived to your office. You're thinking to yourself "Oh, this is too early for me, I shouldn't get out of bed before noon." Considering this you decide to go to the fika room to see if any of your colleagues feel the same way, and in which case you can feel sorry for each other. One of your colleagues is there, sitting in the sofa with a copy of Silberschatz's *Operating System Concepts* in his lap. He looks up at you and says "You're knowledgable in this, I don't understand this kernel and user mode. What's the point of those anyway?"

   Give a short description of

   (3p)   (a) why we need to make the distinction of kernel and user mode, and

   (3p)   (b) the requirements to implement the two modes.

2. Feeling much better after a soft start of the day you return to your desk. You start thinking about the CPU scheduler in the OS of your laptop computer. The scheduler is very good most of the times, but sometimes things feel like their very slow.

   Your train of thought goes down a tricky path.

   (3p)   (a) Explain why not all OSes use the optimal scheduling algorithm shortest-job-first (SJF)?

   (3p)   (b) Also explain what is a good scheduling strategy for an ordinary laptop computer system.

3. Interrupted from your thoughts on scheduling, your colleague from the morning is back again – still with Silberschatz in hand.

   "We add paging to primary memory to remove problems of (external) fragmentation," she says. "In the same manner we divide the secondary memory into blocks (and clusters). Then why do we talk about fragmentation in file systems when it's not an issue in RAM?"

   You're thinking to yourself, "well, that's not true of all file systems, but fine, we're not on that level yet."

   (3p)   (a) Explain what is meant by "fragmentation" when we talk about files in secondary memory.

   (3p)   (b) Explain why this can be an issue in secondary memory but not in primary despite us using the same methods in both places.

(3p) 4. You are finally approaching the end of your day. Thinking back on a day full of interruptions, you start thinking "oh, how I wish I could just turn off preemption sometimes." That reminds you that OSes sometimes turns off interrupts in kernel mode to avoid race conditions, "why couldn't Mother Nature make the world more like an x86-architecture?"

   That the kernel must protect its data structures by locks in a multiprocessor environment is obvious, but why must the kernel do that in a single processor environment too?

   Finally, now it is time for a treat after all this hard work.

The end.

References

[SGG09]   Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 8 edition, 2009. International Student Version.

[SGG13a]   Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013.

[SGG13b]   Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne. *Operating System Concepts*. John Wiley & Sons Inc, Hoboken, N.J., 9 edition, 2013. International Student Version.