Försättsblad till skriftlig tentamen vid Linköpings universitet

Datum för tentamen	2016-06-08
Sal (2)	T1 U3
Tid	14-18
Kurskod	TDIU25
Provkod	TEN1
Kursnamn/benämning **Provnamn/benämning**	Operativsystem Skriftlig tentamen
Institution	IDA
Antal uppgifter som ingår i tentamen	
Jour/Kursansvarig Ange vem som besöker salen	Ahmed Rezine
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Besöker salen ca klockan	
Kursadministratör/kontaktperson (namn + tfnr + mailaddress)	Elin Brödje 013-284767
Tillåtna hjälpmedel	
Övrigt	
Antal exemplar i påsen	

TDIU25 Exam

Ahmed Rezine

2016-06-08 14-18
Hus C

Admitted material

Dictionary from English to your chosen language.

Jour

Ahmed Rezine (013-281938) visiting after about one hour.

Instructions

- Fill in the exam wrapper and read the instructions on it before you start.
  Read instructions and all assignments carefully and completely before you begin.
- You may answer in either English or Swedish.
- State your interpretation of the question and all assumptions you make.
- Write clearly. **Unreadable text will be ignored.**
- Be precise in your statements. **Prove your point when possible.**
  Ambiguous formulations will lead to reduction of points.
- **Motivate clearly and in depth all statements and reasoning.**
  Explain calculations and solution procedures.
- The exam is 40 points and graded U, 3, 4, 5 (**preliminary** limits: 21p, 30p, 35p).
  Points are given for motivations, explanations, and reasoning.

Definitions

Unless you are more specific, the correcting **team will interpret the following terms as follow:**

memory Volatile random access memory **(DRAM), about 100ns access time.**

disk Permanent storage, about 10ms access **time.**

page A fix size region of virtual memory, **possibly on disk.**

frame A fix size region of physical memory **(DRAM).**

block A data block located on disk.

Problem 1 (12p)

Part A. Assume a paged virtual memory with 16 bits logical addresses. Each process can address at most 64 pages.

1. What is the maximal size (in bytes) of a single page? (2pt)
2. Assume one level paging. How large (in bytes) is a page table if we assume 2 bytes for each page entry? (1pt)
3. Does it make sense to have two or more paging levels? Justify. (1pt)
4. Suppose the page table of some process maps pages to frames according to Table (1). What is the physical address corresponding to the virtual address 3076? (1pt)

Part B. Assume now a paged virtual memory with 32 bits logical addresses and 4KiB pages.

1. How many pages can a process address? (2pt)
2. Assume one level paging. What is the size of a process page table assuming 4 bytes page entries? Does the table fit in a single page (2pt)
3. Assume two levels paging. How many bits of the virtual address should you allocate to each level in order to fit each page table (regardless of the level) in a single page? (2pt)
4. How many bits of a first level page entry can be used for information other than the frame of the second level page table? (1pt)

5	...
6	...
0	...
2	...
25	...
...	...

Table 1: First entries of a process page table.

Problem 2 (4p)

1. Describe, in no more than half a page, a buffer overflow security attack. Do not hesitate to make use of a simple sketch to help your description. (2pt)
2. How can segmentation and the underlying hardware help making such attacks more difficult? (2pt)

Job	Arrival time	Execution time
J_1	0	3
J_2	5	2
J_3	6	6
J_4	10	2

Table 2: A 16 time units periodic workload

Problem 3 (12p)

Assume an idle system. Consider the workload depicted in Table (2). Assume the workload is periodic with 16 time units as a period. In other words, if J_i arrived at time t_i the first time (t_1 is 0, t_2 is 5, t_3 is 6 and t_4 is 10) then it will arrive again (with the same execution time) at $16 \times n + t_i$ for each $n \geq 1$. For instance, J_4 arrives at times 10, 26, 42, 58, 74, ... etc.
Assume a one level scheduler using a Round Robin queue with a 4 time units time quantum.

1. Draw a Gantt diagram for processes' execution and queue contents for the first 16 time units. (2pt)
2. What is the waiting time and the turnaround time of each job? (2pt)
3. What is the CPU utilisation ? (2pt)
4. Assuming the processor will only deal with these jobs. Can you put a bound on the maximal size of the ready queue? Justify (2pt)
5. Is the scheduler preemptive? Justify (2pt)
6. Suppose the workload is not fixed. Assume a finite number of jobs can arrive at each time unit and with different execution times. Can a job starve? Justify (2pt)

Problem 4 (8 p)

Assume a 4TiB (i.e., 2^{42} bytes) hard drive. Assume a filesystem that makes use of 32 bits pointers to select logical blocks.

1. What is the minimal size of a logical block? (2pt)
2. Assume 2KiB logical blocks. What is the size of the FAT table corresponding to having a single 4TiB volume? (2pt) recall that FAT is a form of linked allocation but where all links are centralized in a single table for the whole volume.
3. How large (in bytes) should a single logical block be in order to obtain a FAT table of 128 MiB (i.e., 2^{27} bytes) ? (2pt)
4. Compare advantages and disadvantages of the two logical block sizes (i.e, the block sizes adopted/obtained in questions 2 and 3). (2pt)
5. Compare the advantages and disadvantages of FAT and indexed allocation. (2pt)

Problem 5 (4p)

1. What is the difference between access lists and capability lists? give an example of how each of them can be used for access control (2pt)
2. Give an advantage of each of the two access control approaches (2pt).