CS570 Summer 2016 Exam #2

6/15/2016

1. 6/6 2: 4/4 3: 4/4 4: 4/4 5: 4/4 6: 9/9 7: 4/4 8: 6/6 9: 4/9 41 = 50

1. a. An O/S that uses a paged memory management scheme requires the hardware to include a PMMU in addition to the standard computer components.

   b. Name two control bits used in both segmentation memory systems and Paging memory systems:

   dirty bit?

   1. Modification
   2. present

2. Given an O/S which has divided all of fast memory into 3 frames, and if this O/S uses the FIFO algorithm for page replacement/swapping, then how many page faults are generated if the following sequence of pages are requested for use (show your work!): 9

	2	5	2	3	5	4	2	5	1	2	3	2
FIFO	2	5	5	3	3	4	2	5	1	1	3	2
		2	2	5	5	3	4	2	5	5	1	3
				2	2	5	3	4	2	2	5	1
Page fault:	*	*		*	*	*	*		*	*		= 9

3. Repeat #2, but use the LRU algorithm for page replacement/swapping instead. How many page faults? 7

	2	5	2	3	5	4	2	5	1	2	3	2
LRU	2	5	2	3	5	4	2	5	1	2	3	2
		5		2	3	5	4	2	5	1	2	3
				5	2	3	5	4	2	5	1	1
Page fault:	*	*		*	*	*	*		*		*	= 7

4. Consider a virtual memory system using paged memory with 32-bit physical addresses and 32-bit virtual addresses and 18 bits of the virtual address was for the offset.

   a. What size should the pages be (how big do they need to be)? 2^{18} 262,144

   $2^{32} - 2^{18} = 2^{14}$

   b. How many pages can the process have (maximum number)? 16,384

- d:/
- in:/usr
- d:/usr
- in:/usr/include
- d:/usr/include
- in:/usr/include/linux

- d:/usr/include/linux
- in:/usr/include/const.h

5. Given the file system architecture we've studied in the text and in lecture, with data blocks of 1024 byte size, how many disk reads would need to be performed to get the i-node for the following into memory 8 :
/usr/include/linux/const.h
(note, the only node in memory is the i-node for /)

6. Your process needs to access the following three virtual addresses (given in base 10), compute the virtual page number and the offset within that page for each address if page size = 4 KB: 20,092, 45,054, 131,072

4KB → 4096

Addr / page size = Page #

20092/4096 ≈ 4.9 → 4; 45054/4096 ≈ 10.9 → 10; 131072/4096 = 32

offset = Addr − (Page # × page size)

20092 − (4×4096) = 3708; 45054 − (10×4096) = 4094; 131072 − (32×4096) = 0

9

7. Each entry in a typical page table has several control bits to enable the h/w and operating system to manage the pages with. Name the correct control bits for each below:

Answer on back! →

1. This page table entry is valid: O/S present bit
2. The page at this entry has been written to: dirty bit modified bit
3. The page at this entry may be read fm/written to: read bit ~~protection bit~~
4. The page at this entry has been read fm/written to: ~~valid bit~~ reference bit

8. List three advantages of using page-segmented memory over segmented memory. Be specific and explain why it's an advantage:

memory

- "Run-time": page segments are in memory so no time is wasted putting into memory
- "Less fragmentation": The page-segments are not broken up and can be placed sequentially
- "Lookup": can refer to the page table instead of looking at the memory

- reduces fragmentation and holes
- reduces cost of searches
- Less memory during run time

9. A UNIX filesystem has 512 byte blocks and 4 byte disk addresses. What is the maximum filesize assuming inodes have 10 direct, one single, one double, and one triple indirect addresses in each inode?

512/4 = 128 = 2^7 ✓2

0: 10×2^{10} ✓2

single 1: $2^{10} \times 2^7 = 2^{17}$ ✗

double 2: $2^{10} \times 2^7 \times 2^7 = 2^{24}$ ✗

triple 3: $2^{10} \times 2^7 \times 2^7 \times 2^7 = 2^{31}$ ✗

$= 10 \times 2^{10} + 2^{17} + 2^{24} + 2^{31} = 2{,}164{,}402{,}176$

calculator

10×51

$(1 + 128 + 128^2 + 128^3) * 512$ ✓