

CS342 Operating Systems - Fall 2016

Homework 3

Assigned: Dec 7, 2016, Wednesday

Due date: Dec 10, 2016, Saturday, 11:55pm, through Moodle.

Q1. A system has 3 resource types: A, B, and C. There are 5 processes at the moment: P1, ..., P5. Consider the following state. Is it safe or not? Prove your answer. No points without proof. Assume initially (without any allocations), there exist 5 A, 6 B, and 4 C in the system. That means the Existing vector is [5, 6, 4].

	Max			Alloc			
	2	1	1	1	1	0	
	2	2	0	1	0	0	
	2	1	3	0	1	2	
	1	4	0	1	1	0	
	5	2	1	1	2	0	

Q2. Consider a computer that is uses segmentation and paging. The segment table of a process is the following (there are four segments):

Segment	Base	Length
0	0x0200	0x0200
1	0x0800	0x0400
2	0x1000	0x0300
3	0xa000	0x1000
4	0xc000	0x8000

Assume page size is 256 bytes. Assume virtual addresses are 16 bits long. Assume physical addresses are also 16 bits long. Assume a page i is located in a frame $i+16$ (for example, page 0x02 of linear logical memory is in frame 0x12 of physical memory). Assume single level paging is used. A page table entry is 4 bytes long.

- i) Find out the size (in bytes) of the page table of this process.
- ii) Find out the total number of pages that this process is using.
- iii) Convert the following logical addresses into physical addresses.
 - a) (0, 0x01a3)
 - b) (1, 0x0244)
 - c) (2, 0x0000)
 - d) (3, 0x02ff)
 - e) (4, 0x210a)
 - f) (2, 0x0500)

Above, numbers starting with 0x are hexadecimal, otherwise decimal. The physical addresses should be in hexadecimal.

Q3. Assume a process has 3 frames allocated. Consider the following page reference string: 3 6 3 5 6 4 3 5 3 6 5 7 5 7 6 5 3 5 2 3 4. Assume after every 5 references, reference bits are cleared. How many page faults will occur for the following algorithms? a) LRU, b) Second Chance, d) Optimal.

Q4. Consider a file system (FS) that uses index allocation. Assume block size is 4 KB and pointer size (disk pointer, i.e., disk block number) is 8 bytes. 3-level index structure is used for a file. An inode (FCB) for a file contains just one disk block pointer, which may point to the top-level index block for the file. The inode for a file does not have any other disk block pointers.

- a) What is the maximum file size that can be supported in the FS?
- b) How many index blocks are required for a file A of sizes 64 KB, file B of size 64 MB, and file C of size 1 GB.
- c) Assume a block access takes 10 ms. Find out the average random access time to file A, B, and C of question b).

Q5. There are two processes A and B in a system that is using paging. 3 level paging is used with address split scheme: (8 8 8 12). A page table entry is 64 bytes long no matter what kind of a page table it belongs to. Virtual addresses are 36 bits. Process A occupies 4MB of its virtual memory starting at address 0 and Process B occupies 16 MB of its virtual memory starting at address 0. Assume the computer has 2 GB of physical memory.

- a) Find out the amount of physical memory needed to store the page table information of these two processes.
- b) What would be the answer if inverted page table is used?