

COP 4600 - Homework 3

Due April 23, 2009

Problem 1 (Memory): 25 pts

Consider a simple paging system with the following parameters 2^{32} bytes of physical memory, page size of 2^{10} bytes, 2^{16} pages of logical address space.

- How many bits are in the logical address?
- How many bytes in a frame?
- How many bits in the physical address specify a frame?
- How many entries in the page table?
- How many bits in each page table entry? Assume each page table entry contains a valid/invalid bit.

Problem 2 (Virtual memory): 25 pts

Suppose the page table for the process currently executing on the processor looks like the following. All numbers are decimal, everything is numbered starting from zero, and all addresses are memory byte addresses. The page size is 1024 bytes.

Virtual page number	Valid bit	Reference bit	Modify bit	Page frame number
0	1	1	0	4
1	1	1	1	7
2	0	0	0	-
3	1	0	0	2
4	0	0	0	-
5	1	0	1	0

What physical address, if any, would each of the following virtual addresses correspond to:

- 1052
- 2221
- 5499

Problem 3 (Process scheduling): 25 pts

Consider the following set of processes:

Process name	Arrival time	Processing time
A	0	3
B	1	5
C	3	2
D	9	5
E	12	5

Trace the following scheduling algorithms:

- (a) First come first served (FCFS)
- (b) Round robin, quantum = 1
- (c) Round robin, quantum = 4
- (d) Shortest process next (SPN)
- (e) Shortest remaining time (SRT)

For each scheduling algorithm and each process calculate the finish time and the turnaround time, as well as their average values.

Problem 4 (Input / output): 15 pts

- Consider a program that accesses a single I/O device and compare unbuffered I/O to the use of a buffer. Show that the use of the buffer can reduce the running time by at most a factor of two.
- Generalize the result to the case when the program refers to n devices.

Problem 5 (Hard drives, RAID): 10 pts

Consider a 4-drive, 200GB / drive RAID array. What is the available data storage capacity for each of the RAID levels 0, 1, 3, 4, 5 and 6?

Problem 6 (File systems): 25 pts

- What are the advantages of using directories?
- Directories can be implemented either as “special files” that can only be accessed in limited ways, or as ordinary data files. What are the advantages and disadvantages of each approach?
- Some operating systems have a tree structured file system but limit the depth of the tree to some small number of levels. What effect does this limit have on users? How does this simplify the file system design (if it does?).