CPSC 418	Advanced Computer Architecture	Spring 1996

Homework 7: Due 5 Mar

Problem 1 (2 Points) **Page allocation**

Describe how paging memory systems allocate a new page to a process.

Problem 2 (3 Points) **Physical address calculation**

Use a picture and (words and/or pseudo-code) to describe how paging memory systems translate virtual addresses to physical addresses.

Problem 3 (2 Points) **Resource requirements**

What hardware resources and software functionality are required in a paging memory system?

Problem 4 (2 Points) **Page size**

What are the advantages and disadvantages of increasing the size of pages in a flat paging system?

What are the advantages and disadvantages of decreasing the size of pages in a flat paging system?

Problem 5 (3 Points) **Combining paging and segmentation**

How does a two-level paging memory system avoid the problems of segmented and flat-paging systems?

Problem 6 (1 Points) **Swapping segment table**

Why must the highest-level page table (the "segment table" in the AT&T 3B20 and the "directory table" in the Intel x86) remain in physical memory and not be swapped out to disk?

OVER

Problem 7 (6 Points) **Memory usage and memory systems**

The Boondoggle Micro-1 memory system:

- byte (not word) addressing
- 32-bit virtual addresses
- up to 32-bit physical addresses
- 8kB pages
- two-level paging

7(a) (2 Points) How many bits are used for each of the:

- index-into-page
- page protection permission
- level-one index
- level-two index

7(b) (1 Points) How many table pages are required by a process that uses the complete 32-bit address space?

7(c) (3 Points) Given a Micro-1 with:

- 48MB of main memory
- 4MB of memory used by O/S routines and data (*not* including page tables) that cannot be swapped out
- 200 processes
- 80% of processes use 500kB of memory
- 10% of processes use 2MB of memory
- 5% of processes use 10MB of memory
- 5% of processes use 50MB of memory

Assuming that when a page is swapped into main memory, it continues to reside on disk, what is the minimum amount of swap space that the computer must have?

How much main memory can not be swapped out? (Note: the amount of main memory available for user-processes is what remains.)

Problem 8 (1 Points)

How much time did you spend total on the assignment and on each of these problems? Which problems were useful or useless? How well did the lectures and text book prepare you for this homework? Which concepts needed better explanation?