

CS 3733 Review Problems on Paging and Virtual Memory

1) This problem concerns virtual memory.

Assume a machine has a 32-bit virtual address space and is byte-addressable. The physical address space is 26 bits and the page size is 2K bytes. Give the best answer to each of the following that you can. If you need to make additional assumptions to give an answer, state the assumptions you are making. If the answer is a power of 2, leave it in exponential form.

- a) How many frames of physical memory are possible? _____
- b) How many bits of the virtual address space are needed for the page number? _____
- c) How many bits of the virtual address space are used for the page offset? _____
- d) How many bits of the physical address are used for the frame number? _____
- e) How many bits of the physical address are used for the frame offset? _____
- f) How many bits would be needed for a page table entry? _____
- g) How many bytes would be needed for a page table for one process? _____

2) This problem concerns memory address translation in a virtual memory system.

Suppose the TLB has an access time of 5 ns, the main memory access time is 20 ns, and the disk access time is 10 ms. Suppose the page size is 256 bytes, the virtual address space is 32 bits, and the physical memory address space is 24 bits.

The entire TLB and the beginning of the page table are given below. For each of the virtual addresses given in binary below, find the corresponding page number and estimate the time to access the memory location. If possible, give the corresponding physical memory address.

page	frame
5	9
3	7
2	4
6	3

valid	frame
0	5
1	6
1	4
1	7
0	8
1	9
1	3
...	

- a) 01010100010
- b) 10001000101
- c) 00110110100

Logical Address	Page Number	Access Time	Physical Address
a) 01010100010			
b) 10001000101			
c) 00110110100			