COP 4600 HW 1.1

4. To use cache memory, main memory is divided into cache lines, typically 32 or 64  
bytes long. An entire cache line is cached at once. What is the advantage of caching an  
entire line instead of a single byte or word at a time?

Using cache blocks larger than one word takes advantage of spatial locality. Faster access to memory.

5. On early computers, every byte of data read or written was handled by the CPU (i.e.,  
there was no DMA). What implications does this have for multiprogramming?

Multiprogramming keeps the CPU busy during lag from I/O. If no DMA, CPU is occupied by I/O, so multiprogramming gains nothing. The CPU remains busy despite how much I/O.

6. Instructions related to accessing I/O devices are typically privileged instructions, that  
is, they can be executed in kernel mode but not in user mode. Give a reason why these  
instructions are privileged.

Kernel mode has access to the peripheral hardware components. To prevent illegal I/O or simultaneous I/O calls from different processes user programs must make system call to OS to perform I/O.

12. Which of the following instructions should be allowed only in kernel mode?  
(a) Disable all interrupts.

Kernel mode only.

(b) Read the time-of-day clock.

Kernel mode or User mode

(c) Set the time-of-day clock.

Kernel mode only.

(d) Change the memory map.

Kernel mode only

14. A computer has a pipeline with four stages. Each stage takes the same time to do its  
work, namely, 1 nsec. How many instructions per second can this machine execute?

 10^9 = 1,000,000,000