Computer Architecture Homework #7
Due: November 20, 2009 (Friday 5 PM)

1. Suppose we had a block transfer from an I/O device to memory. The block consists of 2048 words and one word can be transferred to/from memory at a time. For each of the following, indicate the number of interrupts needed to transfer a block using:

a) DMA (direct-memory access)

b) interrupt-driven I/O

c) programmed-I/O

2. Give an example where programmed-I/O might be used.

3. Explain the difference between programmed I/O and interrupt-driven I/O.

4. Explain the difference between interrupt-driven I/O and DMA.

5. Assume special I/O instructions are used to fill I/O-controller registers. Why can't a user program use these instructions to communicate with the I/O device directly and "by-pass" the operating system's protection checking?

6. Assume that memory-mapped I/O is used. Since Load and Store instructions are used to communicate with the I/O-controller registers, why can't a user program communicate with the I/O device directly and "by-pass" the operating system's protection checking?

7. Suppose that you are setting up a computer system as a database server for your company. You have enough money to buy a 4 disk RAID array which can configured as either:

- RAID 0 (nonredundant),
- RAID 1 (mirrored)
- RAID 3 (bit-interleaved with a parity disk)
- RAID 5 (block-level with distributed parity blocks)

How would you configure the RAID array? (Justify you answer)

8. Assume an 8-disk RAID array. Each disk has 100 MB/sec data transfer rate.

a) Fill in the following table to compare the following RAID levels **assuming no disk failures.**

RAID Level	Data transfer rate for single, large I/O request	Number of concurrent, small READ requests	Number of concurrent, small WRITE requests
0 (large strip)			
0 (bit-wise interleaving)			
1			
2			
3			
4			
5			

b) Fill in the following table to compare the following RAID levels **assuming one disk failure.**

RAID Level	Data transfer rate for single, large I/O request	Number of concurrent, small READ requests	Number of concurrent, small WRITE requests
0 (large strip)			
0 (bit-wise interleaving)			
1			
2			
3			
4			
5			