Score:_____ Name:_____

ECE 3055 Quiz 10 - November 3, 2004

1.(*5 pts.*) Compare the typical time to read or write a Windows cluster (i.e. a cluster is just a small group of disk sectors that the OS uses to allocate disk space in the file system tables). Assume a cluster has eight 512-byte sectors. Compare the new high performance Western Digital Serial ATA Raptor disk to a standard EIDE disk with these features:

Raptor: Average seek time is 4.5ms (use the book's suggested 1/3 correction factor for a more realistic or typical seek time) a serial ATA transfer rate of 150 Mbytes/sec, the disk rotates at 10,000 RPM, and the controller overhead is .08ms. On both disks, ignore the effects of the cache inside the disk and assume you can read all eight contiguous sectors during a single pass over the disk cluster.

$1/3 \times 4.5ms + .5 \times 60 \times 1000/10{,}000ms + 4096/(150 \times 10^6) + .08 = 4.61ms$

Raptor Typical R/W Time 4.61 ms.

Standard EIDE: Average seek time is 8.9ms (use the book's suggested 1/3 correction factor for a more realistic or typical seek time) an Ultra IDE transfer rate of 66 Mbytes/sec, the disk rotates at 7,200 RPM, and the controller overhead is .1ms.

$1/3 \times 8.9ms + .5 \times 60 \times 1000/7{,}200\,ms + 4096/(66 \times 10^6) + .1 = 7.3ms$

EIDE typical R/W Time 7.3 ms.

The new Raptor SATA drive is 58 % faster.

2. *(3 pts.)* The original PC XT ISA bus requires 5 clocks to transfer 8-bit data. If the ISA bus clock is 4.77Mhz, what is the maximum I/O bandwidth?

$1 byte \times 4.77 \times 10^6 / 5 clocks = .954 \times 10^6$

PC ISA maximum I/O bandwidth is .954 megabytes per second.

3. *(2 pts.)* Which I/O transfer technique allows a CPU to perform other operations while an I/O buffer is being transferred to/from memory? List all additional hardware needed to support it.

DMA
needs DMA controllers (state machine with address counter) & interrupt hardware to signal CPU when transfer completes