ECE 3055 Quiz - October 30, 2002

2 pts. **1.** What is the average time to read or write a sector on a disk drive that has an average seek time of 8.5ms. The drive rotates at 7,200 RPM, has a transfer rate of 20 megabytes per second, and 512 byte sectors. Assume the disk is idle and there is a .2 ms controller overhead per sector. (*Note*: In I/O device transfer rates, MB is always 10^6 bytes – not 2^{20} bytes!)

$$8.5\,ms + \left(\frac{0.5\,rev}{(7200/60)}\right) + \frac{512}{20\,MB/s} + .2\,ms$$

Average R/W time per sector = ___12.89___ (in ms.)

$$8.5 + 4.167 + .0256 + .2$$

2 pts. **2.** In problem 1, if the head was already positioned over the correct track and the sector was just starting to rotate under the R/W head, what would the minimum time be?

no seek time, no rotational latency

$$.0256 + .2$$

Minimum R/W time per sector = ___.2256___ (in ms.)

$(.0256 \quad -1\,pt. \quad need\ controller\ overhead)$

2 pts. **3.** The PCI bus in current PCs can transfer a 32-bit data packet in one 133Mhz clock cycle (assuming you ignore the initial clock cycle required to transfer the starting address). Compute the maximum I/O bandwidth in megabytes per second.

$$133 \times 10^6\ cycles/sec \times 32\ bits/cycle \times \frac{1}{8}\ bits/byte$$

PCI bus maximum I/O bandwidth = ___532___ (in megabytes per second)

2 pts. **4.** The new PCI Express (3GIO) is the next generation replacement proposed for the PC's PCI bus. It will support clock rates from to 2.5 to 10 GHz using one wire. Assuming it can transfer a bit every clock cycle, compute the maximum bandwidth of the new PCI Express bus using one wire.

$$10 \times 10^9 / 8\,bits/byte = 1.25 \times 10^9 = 1250 \times 10^6$$

PCI Express maximum I/O bandwidth = ___1250___ (in megabytes per second)   1pt.

With just one wire, PCI Express could be up to __2.35__ times faster than the current PCI bus.   1pt.

2 pts. **5.** Other than address and data lines, what is the other main category of signal lines needed on an I/O bus? Explain

control lines which include
bus status & commands (i.e. read write etc)
clock signals
interrupt signals

(−1pt. if only clock, or handshake, or interrupt
signals & not all control/command lines)