Score:_____ Name:_____

## ECE 3055 Quiz - October 29, 2008

1. What is the average time to read or write a sector on a new Western Digital VelociRaptor disk drive that has an average seek time of 4.2 ms. The drive rotates at 10,000 RPM, has an SATA transfer rate of 3Gb/s per second, and 512 byte sectors (i.e. lower case "b" is bits). Assume the disk is idle and there is a .8 ms controller overhead per sector. (*Note*: In I/O device transfer rates, MB is always $10^6$ bytes – not $2^{20}$ bytes!)

$$4.2\text{ms} + \frac{0.5}{10{,}000/60} + \frac{512\text{ bytes}}{3\times10^9/8} + .8\text{ms}$$

3pts.

$$4.2 + 3 + .00136 + .8\text{ ms}$$

Average R/W time per sector = 8 (in ms.)

2. In problem 1, instead of the average what would the minimum and maximum transfer times be? You can assume maximum seek time is twice the average seek time and the disk has an internal drive cache hit for minimum time. Assume a drive cache hit has the same transfer and controller overhead times.

2pts. no seek or rotational latency

Minimum R/W time per sector = .8014 (in ms.)

$$(4.2\times2)+(3\times2)+.00136+.8\text{ ms}$$

Maximum R/W time per sector = 15.2 (in ms.)

3. A PCI bus has a 133 Mhz clock and can transfer 32-bit data packets from successive memory locations every two clock cycles after using an initial clock cycle for the starting address. Assuming the typical transfer size is four 32-bit data packets in 9 clocks, compute the maximum I/O bandwidth in megabytes per second.

3pts. $4\times4\times133\times10^6/9$

Maximum I/O bandwidth = 236.4 (in megabytes per second)

4. What are the important advantages of interrupt driven I/O over programmed I/O (i.e., software polling) in a complex computer system? Explain exactly why this is the case.

2pts. no CPU overhead for wait loops on ready bits also can save power in addition to CPU clock cycles.