

Score: \_\_\_\_\_

Name: \_\_\_\_\_

## ECE 3055 Quiz - October 29, 2003

3 pts.

1. What is the average time to read or write a sector on a disk drive that has an average seek time of 8ms. The drive rotates at 15,000 RPM, has a transfer rate of 50 megabytes per second, and 1024 byte sectors. Assume the disk is idle and there is a .1 ms controller overhead per sector. (Note: In I/O device transfer rates, MB is always  $10^6$  bytes – not  $2^{20}$  bytes!)

$$8ms + \frac{0.5}{15000/60} + \frac{1024}{50 \times 10^6} + .1ms$$

$$8ms + 2ms + .0204ms + .1ms$$

Average R/W time per sector = 10.12 (in ms.)

3 pts.

2. In problem 1, what would the Maximum transfer time be? You can assume maximum seek time is twice the average seek time.

$$16ms + \frac{1}{15000/60} + \frac{1024}{50 \times 10^6} + .1ms$$

$$16 + 4 + .02048 + .1ms$$

Maximum R/W time per sector = 20.12 (in ms.)

2 pts.

3. A bus has a 200Mhz clock and can transfer 64-bit data packets from successive memory locations every clock cycle after using an initial clock cycle for the starting address. Assuming the typical transfer size is 4 data packets in 5 clocks, compute the maximum I/O bandwidth in megabytes per second.

$$200 \cdot \left( \frac{4 \times \frac{64}{8}}{5} \right) \times 10^6$$

Maximum I/O bandwidth = 1280 (in megabytes per second)

2 pts.

4. List and briefly describe the three major ways I/O transfers can occur in a computer system. Rank the hardware and the CPU overhead required for each from 1 to 3 with 1 being lowest.

I/O Transfer TechniqueHardware Needed CPU overhead

Polling or Programmed I/O	1	3
Interrupt Driven I/O	2	2
DMA (Direct Memory Access)	3	1