Score:_____ Name:_____

ECE 3055 Quiz 10 - October 28, 2009

1. What is the average, maximum, and minimum time to read a 64KB block of file data on a new Western Digital VelociRaptor disk drive that has an average seek time of 4.4 ms. The drive rotates at 10,000 RPM, has a 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 .7 ms controller overhead per sector. Adjust average seek time **with** the book's ¼ suggested correction factor for observed or measured seek time. Do not consider the internal disk controller's cache in your calculations. (*Note*: In I/O device transfer rates, MB is always 10^6 bytes – not 2^{20} bytes!

$4.4/4 + \frac{.5}{10,000/60} + 128\left(\frac{512 \times 8}{3 \times 10^9} + .7\right)$

3pts $128\left(8.8 + \frac{1}{10,000/60} + \left(\frac{512 \times 8}{3 \times 10^9} + .7\right)\right)$

Part 1: Average time = 93.9 **ms**

Part 2: Maximum time = 198.4 **ms** $0 + 0 + 128\left(\frac{512 \times 8}{3 \times 10^9} + .7\right)$

Part 3: Minimum time = 89.7 **ms**

2. The original IBM PC XT used an ISA bus. The ISA bus ran at 4.7Mhz and required 5 clock cycles to transfer a single data byte. Compute the maximum I/O bandwidth of the bus in megabytes per second. This bus became too slow as processors and memory became faster (with smaller faster transistors, pipelining, and caches) and it was eventually replaced by the faster PCI bus.

2pts $\frac{4.7 \times 10^6}{5}$

Maximum I/O bandwidth = .94 (in megabytes (i.e, 10^6 bytes) per second)

3. An application is being ported to a multicore computer system with 8 processor cores. Assuming 75% of the original sequential execution time is numerical computations that can be evenly divided among 8 processors and the remaining 25% is I/O that must be performed sequentially on one processor, what is the maximum speedup that could be obtained on the computer using all 8 cores? To obtain this speedup on the PC, the application must be rewritten to use 8 threads and the OS can assign and run one thread per core.

3pts $\frac{1}{\left(\frac{.75}{8} + .25\right)} = 2.91$

Maximum Speedup = 2.91

4. What is "Thumb" in relation to ARM processors and how does it save power in small systems?

2pts 16bit instructions that allow a 16 bit memory interface (vs. 32). Saves hardware and power.