CALIFORNIA STATE UNIVERSITY
FULLERTON

EGCP-381: Computer Design and Organization

Lecture 13

Exam 2 Guide

What's Allowed

Allowed	Not Allowed

• A single 8.5" x 11" cheat sheet front/back
• Scientific calculator
  • No graphing calculators
• Something to write with, preferably a pencil
	• Books
	• Computers
	  • At the start of class, the computers will be locked (no exceptions)
	• Cell phones
	  • For any reason
	• Homework solutions
	• Labs

Areas of Focus

- Disk Performance
- DMA Module
- PicoBlaze Assembly and Timing
- Programmed, Interrupt-Driven, DMA I/O
- **I will not ask any VHDL coding questions**

Suggestions

- Study the lectures
- Study the homework
- Look over your labs

1: Timing Comparison Example

- Let's say we are using a disk with the following parameters:
  - Average Seek Time: 4ms
  - Rotation Speed: 15,000 rpm
  - 512-byte sectors
  - 500 sectors per track
- Suppose we read a file consisting of 2500 sectors for a total of 1.28 MB
- What would be the total transfer time?

1:Timing Comparison Example

- Assume the file is sequentially organized
  - Occupies all sectors of 5 adjacent tracks

$$5\ tracks \times 500 \frac{sectors}{track} = 2500\ sectors$$

- Average seek time is given as 4ms
- Average rotational delay

$$15{,}000 \frac{rev}{min}\left(\frac{1\ min}{60\ sec}\right) = 250 \frac{rev}{sec}\left(\frac{1\ sec}{1000\ ms}\right) = 0.25 \frac{rev}{ms}$$

  - 1 rev per 4ms
  - Average rotational delay (about half a rev) = 4ms/2 = 2ms
- Transfer time (read/write) for 1 track

$$T = \frac{b}{rN} = \frac{512B * 500\ sectors}{250\ rps \cdot (512B * 500\ sectors)} = 4ms$$

1:Timing Comparison Example

- Time to read the 1st track:

Average Seek	4 ms
Average Rotational Delay	2 ms
Read 500 Sectors (Transfer Time)	4 ms
	10 ms

- B/c tracks are adjacent, no seek time
- So, for the following tracks, the time to read is:

$$Rotational\ Delay + Transfer\ Time = 2ms + 4ms = 6ms$$

- To read the entire file is:

$$Total\ Time = 10ms + (4 \times 6ms) = 34ms$$

1: Timing Comparison Example

- Now, let's assume the data is randomly distributed over the disk (random access)

Average Seek	4 ms
Average Rotational Delay	2 ms
Read 1 Sector (Transfer Time)	0.008 ms
	6.008 ms

- Transfer time (read/write) for 1 sector

$$T = \frac{4ms}{500\ Sectors} = 0.008\ ms$$

- Total time is:

$$Total\ Time = 2500 \times 6.008 = 15{,}020ms = 15.02s$$

- Much different result, depends on how data is organized on disk

2: Interrupt-Driven I/O Example

- Problem 7.9
  - A particular system is controlled by an operator through commands entered from a keyboard
  - The average number of commands entered in an 8-hour interval is 60

a. Suppose the CPU scans the keyboard every 100ms. How many times will the keyboard be checked in an 8-hour period?
   - The CPU scans the keyboard 10 times per second
   - In 8 hours, the number of times the keyboard is scanned is 10 x 60 x 60 x 8 = 288,000

b. By what fraction would the number of CPU visits to the keyboard be reduced if interrupt-driven I/O were used?
   - Only 60 visits would be required
   - The reduction is 1 – (60/288000) = 0.999, or 99.9%

3. Lab 5

- Coding and instruction
- Timeline with different registers such as interpret