

## When / Where

Monday, 10 March 2008, 12:40-13:30 Central **Daylight** (yawn, yawn) Time

Taylor 3142 (Here)

## Conditions

Closed Book, Closed Notes

Bring one sheet of notes (both sides), 216 mm × 280 mm.

No use of communication devices.

## Format

Several problems, short-answer questions.

## Resources

Solved tests and homework: <http://www.ece.lsu.edu/ee4720/prev.html>

Statically Scheduled MIPS Study Guide:...

... <http://www.ece.lsu.edu/ee4720/guides/ssched.pdf>

## Study Recommendations

Study this semester's homework assignments. Similar problems may appear on the exam.

Solve Old Problems—memorizing solutions **is not the same** as solving.

Following and understanding solutions **is not the same as** solving.

Use the solutions for brief hints and to check your own solutions.

## Previous Midterms

## MIPS Programming and Instruction Use

Should be able to write MIPS programs.

Should be able to easily understand MIPS programs.

Should be able to use other ISAs' instructions in examples.

Not required to memorize instruction names, except for common MIPS instructions.

## MIPS Implementation

Implementation Diagrams and Pipeline Execution Diagrams

They are a *team*, so study them together.

## ISA Families

MIPS v. SPARC

MIPS v. ARM

ISA v. Implementation.

*See Lecture Slides 1*—<http://www.ece.lsu.edu/ee4720/2008/lsl101.pdf>

Why separating ISA from implementation is important.

Why it's hard to design an ISA without bias towards first implementation.

CPI and Performance Measurement

*See Lecture Slides 2*—<http://www.ece.lsu.edu/ee4720/2008/lsl102.pdf>  
*and some material in Optimization*—<http://www.ece.lsu.edu/ee4720/2008/lopt.html>

Definition of CPI.

Relationship between clock frequency, insn count, CPI, and performance.

## MIPS ISA

*See MIPS Overview*—<http://www.ece.lsu.edu/ee4720/2008/lmips.html>

Write and read programs.

Understand how instructions are coded.

## Statically Scheduled MIPS Implementations

*See Lecture Slides 6—<http://www.ece.lsu.edu/ee4720/2008/lsl106.pdf> and Statically Scheduled Study Guide—<http://www.ece.lsu.edu/ee4720/guides/ssched.pdf>*

### Unpipelined Implementation

Understand relationship between insn format and connections to register file, etc.

### Pipelined Implementations

Basic (no bypassing).

ALU bypassing, branch in ID.

Dependency Definitions

Hazard Definitions

For a Given Pipelined Implementation

Show pipeline execution diagrams.

Show register contents at any cycle.

Determine control hardware.

Determine CPI.

## ISA Families: RISC, CISC, VLIW

*See ISA Families Overview*—<http://www.ece.lsu.edu/ee4720/2008/lrisc.html>

Key distinguishing features and their rationale.

RISC: Goal: Easy pipelining, simple (relatively) implementation.

Fixed-length instructions, balanced work, aligned memory access.

CISC: Goal: Powerful instructions, compact code size.

Flexible operand types, multiple-activity instructions.

VLIW: Goal: Easy superscalar implementation.

Bundled instructions, dependence information.



## RISC to RISC Differences: MIPS v. SPARC and MIPS v. ARM

*See ISA Families Overview*—<http://www.ece.lsu.edu/ee4720/2008/lrisc.html>

*See Homework 2 Solution*—[http://www.ece.lsu.edu/ee4720/2008/hw02\\_sol.pdf](http://www.ece.lsu.edu/ee4720/2008/hw02_sol.pdf)

Opcode fields (and their extensions).

Immediate operands, immediate sizes.

Integer branches.

Predicated (conditional) instructions.

## Compilers and Optimization

*See Optimization Lecture Notes—<http://www.ece.lsu.edu/ee4720/2008/lopt.html>*

Steps in building and compiling.

Basic optimization techniques, compiler optimization switches.

Profiling.

How programmer typically uses compiler switches (options).