Final Exam

• When: 8:00-10:00 am Friday, May 14th
• Location: here

• 1/3: midterm material
  – See lecture notes for midterm preparation
• 2/3: material since midterm

• 1 page of personal notes
• No electronic devices/books/other notes
Final Preparation

• Exam discussion on D2L
  – Post sample questions (and answers)
  – Some may appear on the exam
• Look to homework assignments and exams from last year (both the midterm and final) for the types of questions
  – Note that class coverage in previous years has been different
Pre-Midterm Material

• Basic gates
• Boolean algebra
• Digital circuits and circuit reduction
• Number representations (binary, hex)
• Arithmetic: incrementing, decrementing and shifting
• Bit-wise operators
• D-type Flip-flops and sequential logic
• Serial communication (physical + C code)
• Analog processing and sensor models
Key Microprocessor Components

• Data bus
• Data memory (RAM)
• Program memory (EEPROM in our case)
• General- versus special-purpose registers
  – Instruction register
  – Program counter
• Instruction decoder
• Arithmetic Logical Unit
Memory

- Components and behavior
- Types of memory
- Memory elements
- Primary I/O lines
  - Address
  - Data
  - Chip select
  - R/W
  - Clock
Microcontroller I/O

- Function of the primary components
  - DDRx
  - PORTx
  - PINx
- Relationship to C code
New Material

- Timer/counters
- Interrupts and interrupt service routines
- Shared data
- Pulse-width modulation
- Motor control (H-bridges)
- Finite state machines
Timer/Counters

• Prescalars
• Counters (hardware)
  – Timer0, timer2: 8-bit
  – Timer1: 16-bit
• Interrupts on timerX overflow

• Computing timerX count frequencies/periods
• Computing timerX interrupt frequencies/periods
Interrupts

• What are they?

• Interrupt service routines. Examples:
  – Pulse Width Modulation (PWM)
  – Producing digital signals of various frequencies (e.g., can introduce software counters, too)

• Shared data between ISR and main program
  – Shared data problem
Finite State Machines

• Definition
  – States
  – Events
  – Transition function
  – Outputs and output function
• State transition diagrams
• FSMs for control
C Code

• Be prepared to read (and possibly fix) simple C code
• Look to lecture discussions of code and your projects as you prepare