Final Preparation
Questions?
Final Exam

- When: 8:00-10:00 am Tuesday, May 10\textsuperscript{th}
- 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
Exam Parameters

• Most questions: multiple choice
  – Can grade your exam as you leave
• Assigned seating
Sources of Material

- Exam discussion on D2L
  - Post sample questions (and answers)
  - Some may appear on the exam
- In-class and Zyante exercises
- Pencasts; linked web pages
- Lecture notes
- Homework assignments and exams from prior years (both midterms and finals)
Pre-Midterm Material

• Number Representations (binary, hex)
  – Two’s complement for signed numbers
• Arithmetic: incrementing, decrementing and shifting; computing the negative of a number
• Bit-wise operators
• Analog to digital conversion (and vice versa)
• Digital I/O on the Atmel Mega processors
• Basic circuits: LEDs, analog comparators, resistors
• Motor control: H-bridges; PWM
New Material

- Proportional-derivative control
- Timer/counters
- Interrupts and interrupt service routines
- Finite state machines
- Serial communication and the ASCII representation
- Fixed point math
Proportional-Derivative Control

• Key PD control equation
• Meaning of the gains
Timer/Counters

- Prescalers
- Counters (hardware)
  - Timer 0, 2: 8-bit
  - Timer 1, 3, 4, 5: 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) generation (see slides)
  - Producing digital signals of various frequencies (e.g., can introduce software counters, too)
Finite State Machines

• Definition
  – States
  – Inputs / Events
  – Transition function
  – Outputs / Actions
  – State transition diagrams

• FSMs for control
C Code

• Be prepared to read (and possibly fix) simple C code
• If any, you will not write more than a few lines of code
• Look to lecture discussions of code and your projects as you prepare
Serial Communication

• Synchronous vs asynchronous communication
• Asynchronous:
  – Start bit for clock synchronization
• ASCII representation of characters
Character Representation: ASCII
Fixed Point Math

• Converting between floating point and fixed point representations
• Addition, subtraction, multiplication and division of fixed point numbers