This week.....

- Grading caught up:
  - HW 1
  - Quiz 1-3
  - HW 2: discuss today

- Midterm on Thursday
- Project 1 due next Tuesday (minus break)
Midterm Preparation

• Exam discussion on D2L
  – Post sample questions (and answers)
• Look to homework assignments, and in-class and online quizzes
• Exams from previous years
  – Warning: coverage is quite different
Midterm Exam

- No books
- No electronic devices
- You may bring 1 page of your own notes
  - Double-sided
- Assigned seating
Number Representations

• Conversion between binary and:
  – Decimal
  – Hexadecimal

• Unsigned versus signed (2’s complement) representations

• Bit-wise operations: &, |, ~, ^
Arithmetic

- Adding/subtracting binary numbers
- Taking the 2’s complement of a number
- Shifting left/right (multiplication/division by 2)
Microprocessor Components

• Memory

• Registers:
  – General purpose
  – Special purpose, e.g.:
    • Program counter
    • PORTx, PINx, DDRx

• Arithmetic logical unit

• Data bus
Memory

- Addresses versus values
- Reading from versus writing to
- ROM versus RAM
- ROM versus EPROM (or Flash)
Atmel Digital Input/Output

How to use:
- DDRx
- PORTx
- PINx

You will be asked (in the context of a circuit):
- What a program does
- How to fix a program with bugs
Moving Between Analog and Digital

Digital to Analog:
• Resistive network
• Pulse width modulation + RC circuit

Analog to Digital:
• (analog comparator device)
• Successive approximation