GENERAL MEASUREMENTS LAB
PHYS 339 – CALIBRATION

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MARKING SCHEME

Title	Weight
Introduction to the PC report Counting statistics report Calibration of Arduino microcontroller report Calibration of Arduino microcontroller test Properties of laser report Temperature controller report	10% 15% 5% 10% 15% 15%
Project proposal Project report	5% 20%
Log book	5%

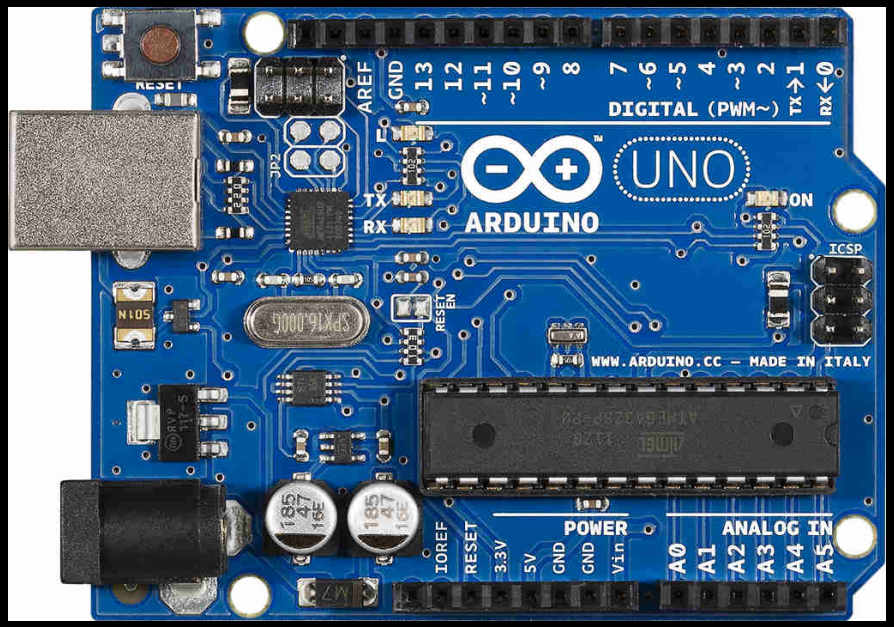
February 26, deadline for project proposal. 1 month away!!

LAB OVERVIEW

- GOAL OF THIS LAB:
  - Calibration of Digital – to – Analog Converter (DAC)
  - Calibration of Analog – to – Digital Converter (ADC)
- WHY?
  - To CONTROL something, you need to know the calibrated voltage corresponding to the digital number you send to the microcontroller.
  - To READ something, it often sends you a voltage related to a physical quantity so the value must be calibrated for it to mean something.

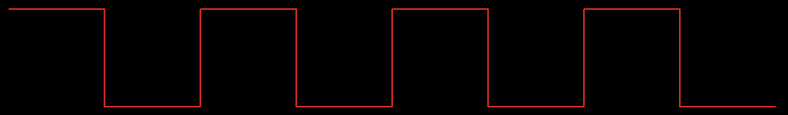
ARDUINO I/O

DAC (note: not true analog out)



8-bit digital number sent to outputs = N_{DAC}

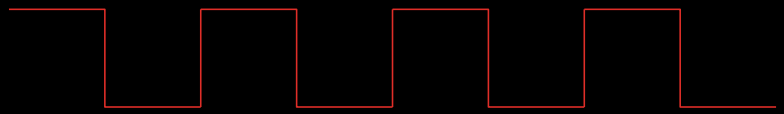
- $2^8 = 256$
- i.e. input ranges from 0 to 255 (unsigned)



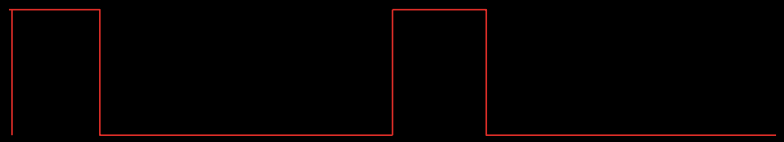
PULSE WIDTH MODULATION

- The catch…NOT a real DAC.
- Uses Pulse Width Modulation + low pass filter.
- Input changes duty cycle.

100% duty cycle (maximum)

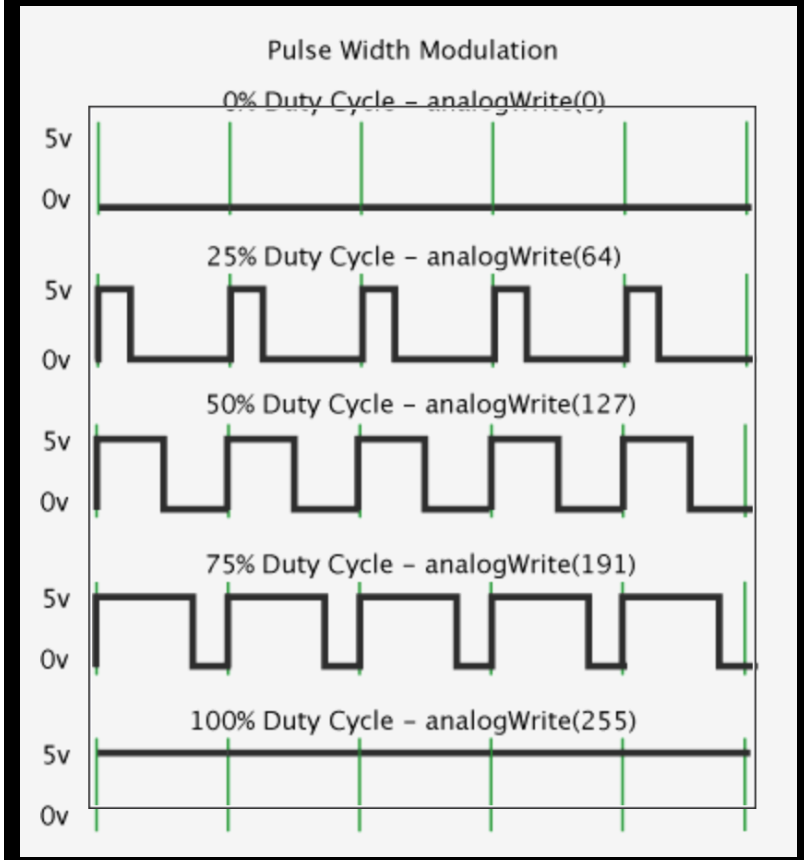


50% duty cycle

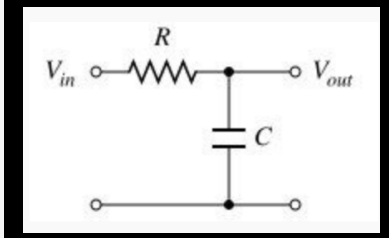


25% duty cycle

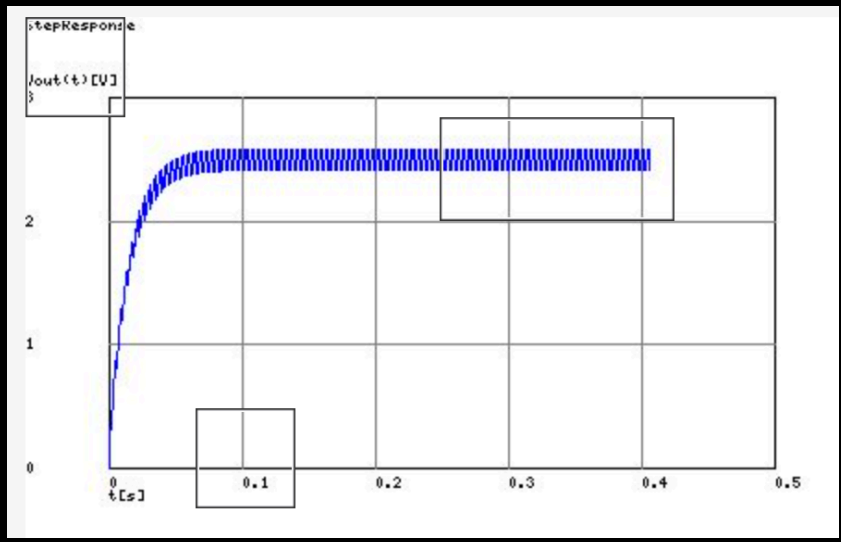
FAKING A DAC



Low pass filter



Voltage out (V)



Time (seconds)

CALIBRATION

- Use a voltmeter to calibrate your pseudo-DAC.
  - Use linear regression to determine DAC characteristics.
  - Write function to give a voltage on command.

- Use your new DAC to:
  - Write to your ADC's, check if working/similar characteristics
  - Write function GetVoltage()
  - Investigate low pass filter using oscilloscope.
- Make a function generator!
    - Demonstrate sinewave, triangle, squarewave and sawtooth
    - Discuss limitations of generator in report
    - I will verify that it works and question you on its limitations (5 points)