Arduino Basics

Lecture 5

Overview

- Learn how to use a microprocessor system/ platform development board
- Arduino UNO
- Hardware
- Software
- Projects

Computers

- What is a computer
  - Fast Nitwit
    - ❑Perform instructions very quickly
    - ❑Needs to be told what to do.
- Computer types
  - Mainframes
  - Minicomputers
  - Personal Computers
  - Microprocessors
- All have similar hardware and need software or programs to operate them

Computer Hardware

- Main Components Circuits
  - Central Processing Unit(s) – CPU
    - ❑ This is where the instructions are performed
  - Memory – Random Access Memory and Read Only Memory
    - ❑ This is where the data and program that is running is stored
  - Timer/Clock
    - ❑ This is the hardware that coordinates the computer operations
  - Data and control buses
    - ❑ This is the digital highways where data and control messages transfer within the computer
  - Input and Output interfaces – I/O ports
    - ❑ This is the digital highways and connections to enter data and display results
- Peripheral Equipment
  - Keyboards
  - Monitors
  - Disk Drives

General Purpose Computers Vs Special Purpose Computers Vs Microprocessors

- General purpose computers are designed to handle a variety of tasks.
- Special purpose computers which can be programmed to perform a desired task.
- In general, a microprocessor falls into the Special Purpose Computer class.
- Various Microprocessors
  - Intel 8088
  - Zilog Z80
  - Motorola 6800
  - Etc.

Microprocessor Systems or Platforms

- Microprocessors contain components to afford development of computer based systems.
- Various types
  - Arduino
  - Raspberry Pi
  - Etc.

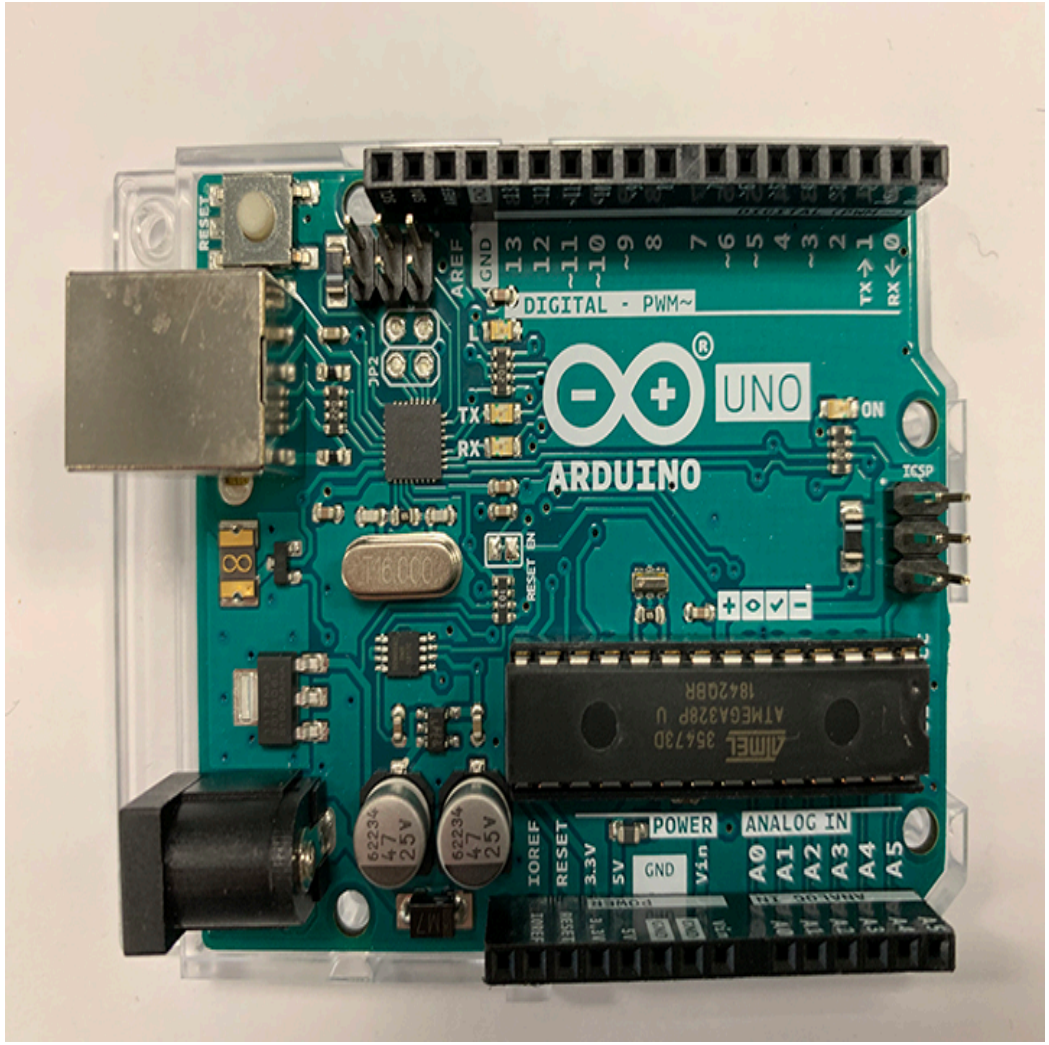
Arduino

- **Arduino** is an open-source hardware and software company[1]
- Builds single board microcontrollers and microcontroller kits[1]
- Arduino board designs use a variety of microprocessor chips and controllers.[1]
  - Uno
  - Mega similar to the Uno but bigger with more I/O port
  - Lilypad used for wearable projects
  - Nano smaller than the Uno
  - Etc.

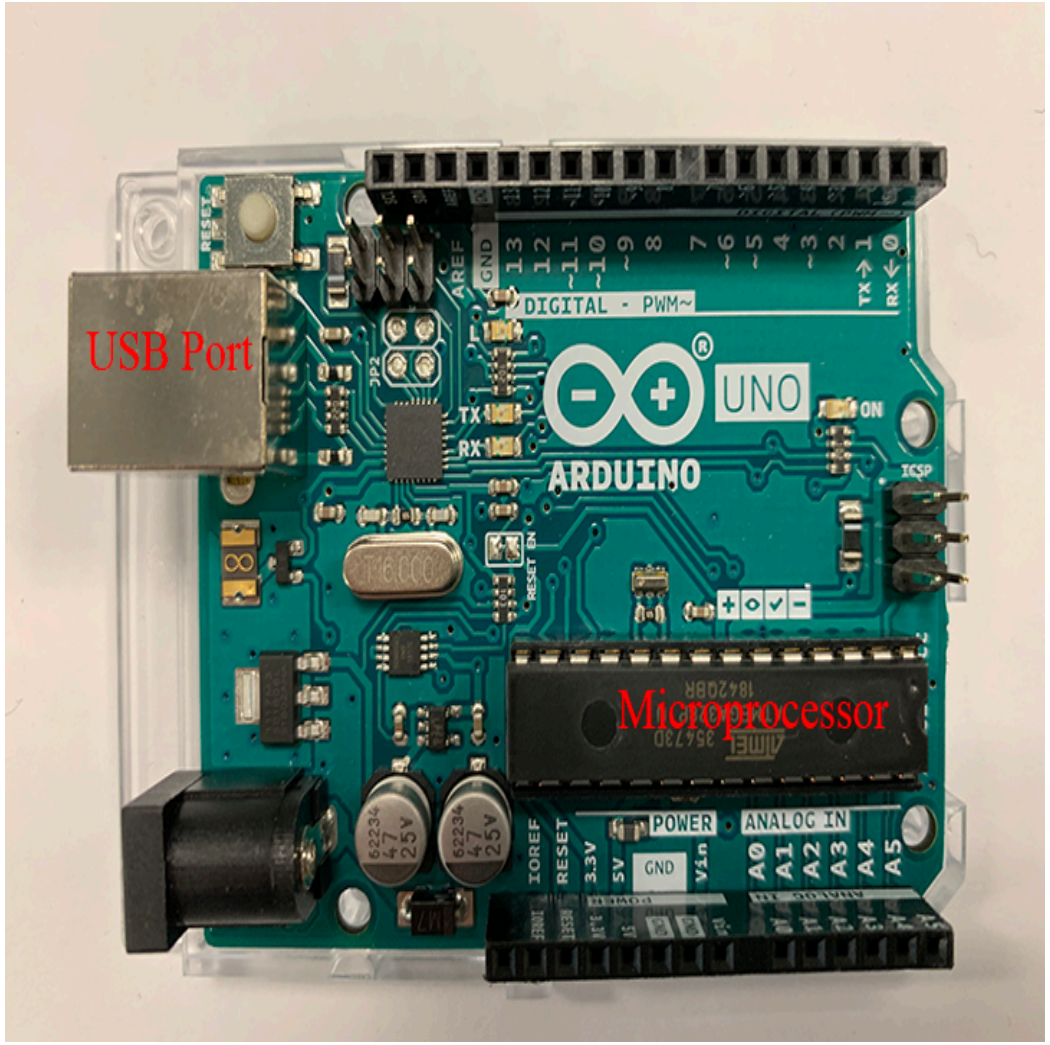
[1] wikipedia.org/wiki/Arduino

Arduino Board Hardware

Arduino Board

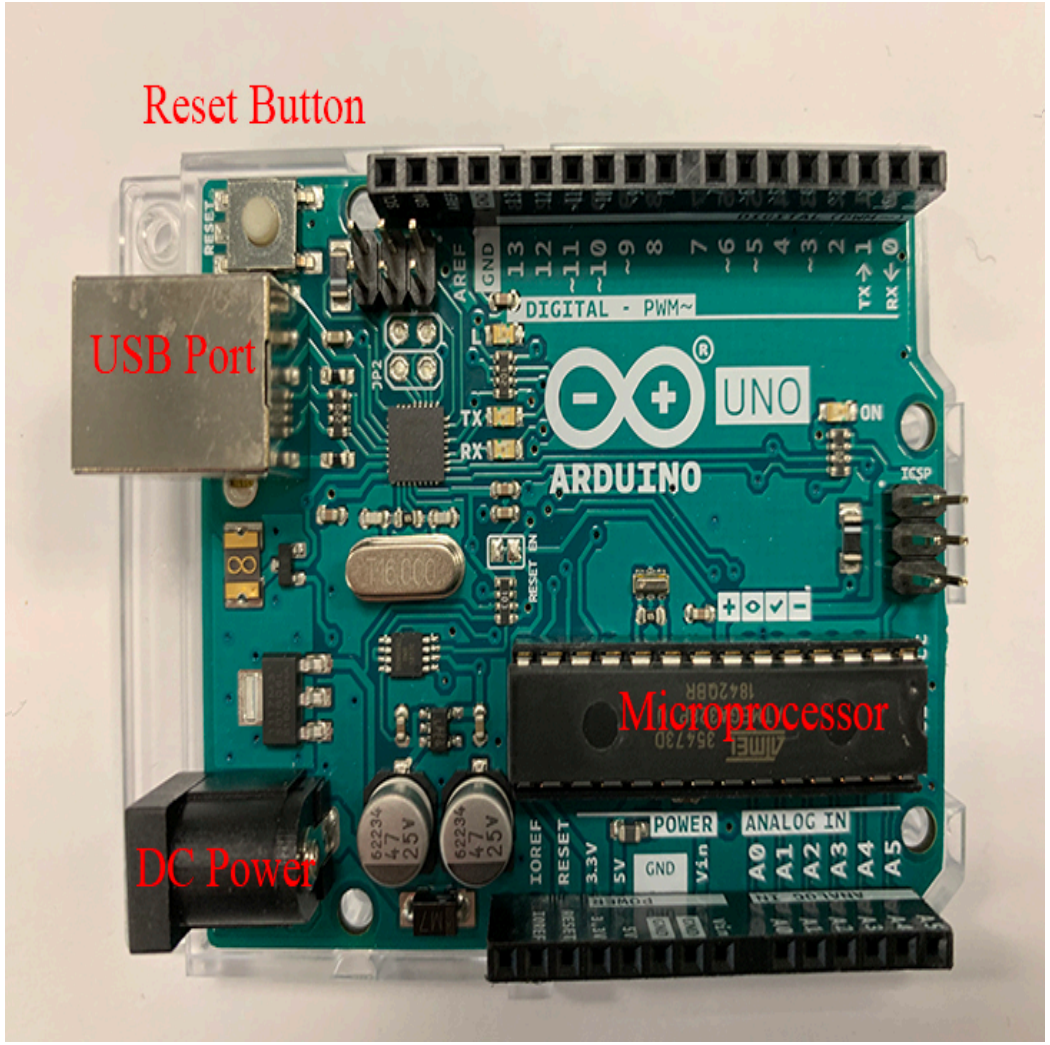


Arduino Board



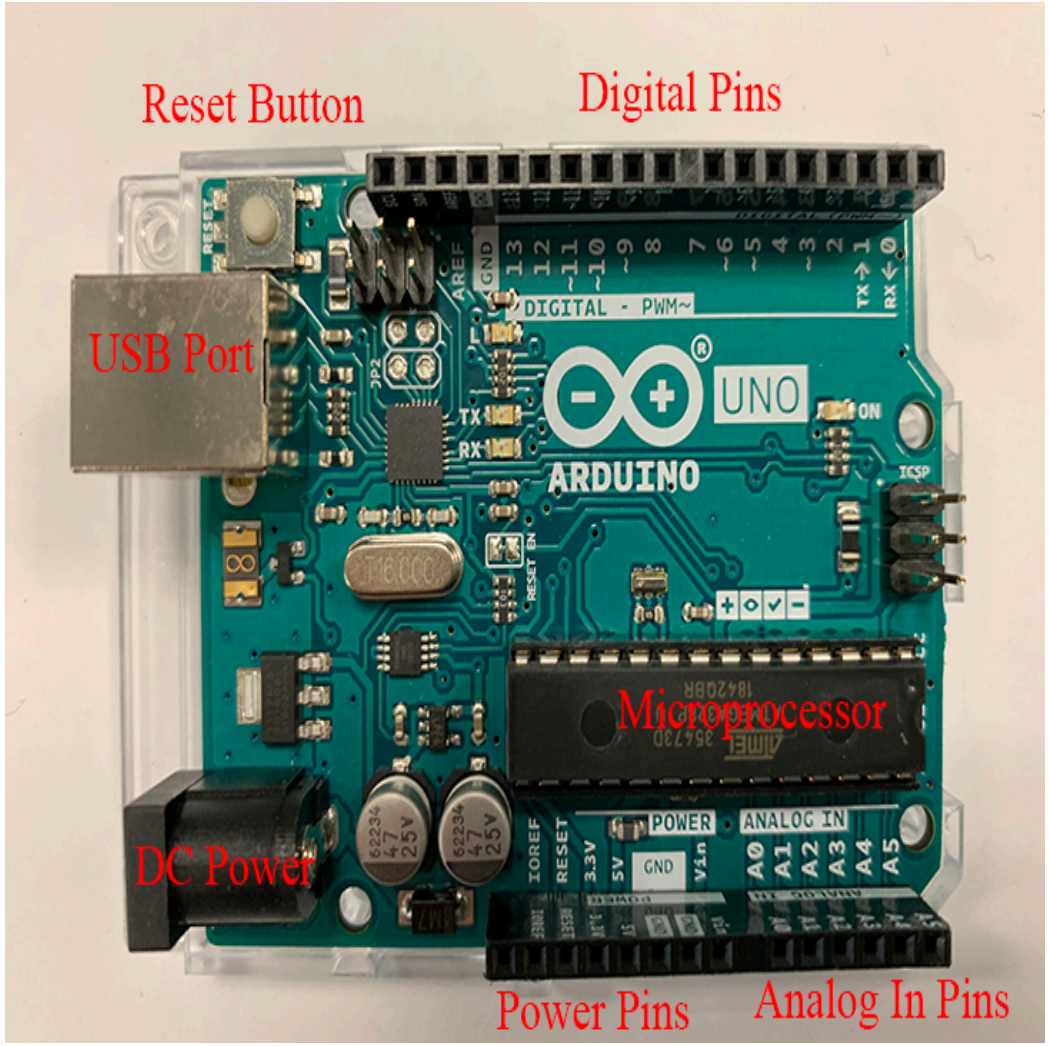
- Microprocessor: ATmega328P
- USB Port: Connect to Computer

Arduino Board



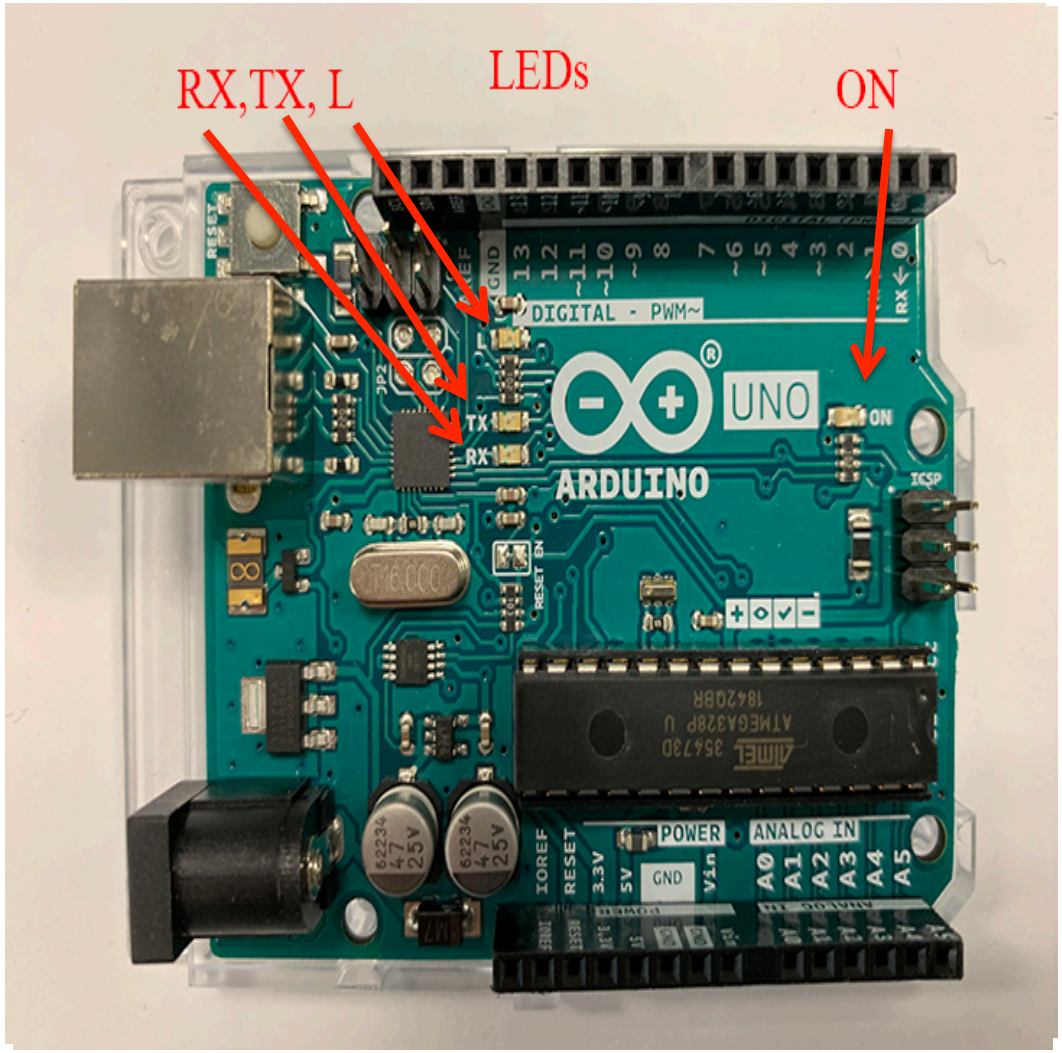
- Reset Button: Resets the program but does not remove the program from memory
- DC Power: Connect to external DC Power Source

Arduino Board



- Digital Pins: Can be used as an input or output and can take on one of two values: 0 or 5 volts. Note that Pins 0 and 1 can be used for serial communications.
- Analog In Pins: Used as an Analog input and can take on any value from 0 to 5 volts.
- Power Pins: Provides 5 volts, 3.3 volts and Ground Reference

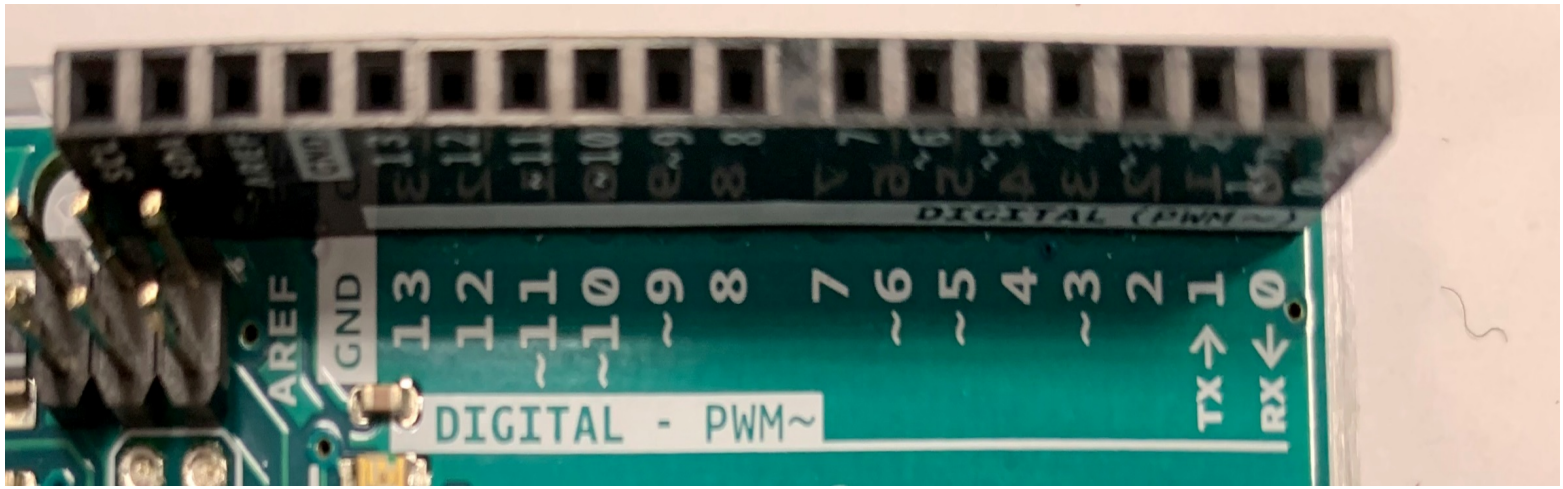
Arduino Board



- ON LED: When illuminated indicates that the Arduino is operating
- RX and TX LEDs: Indicates that the Arduino is receiving/ transmitting Data (e.g. when the program is downloaded from the computer
- L LED: Programmable LED via Digial pin 13

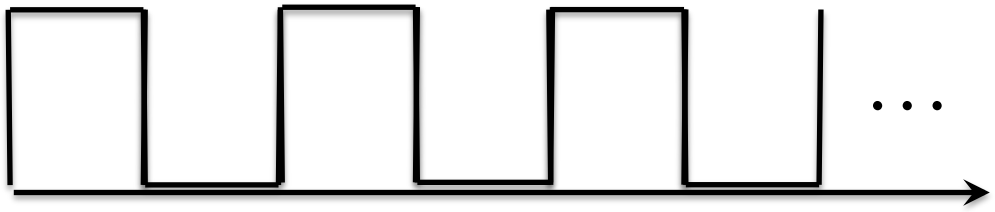
Pulse Width Modulation

- Some of the digital pins (~3, ~5, ~6, ~9, ~10, ~11) with tildes can output a PWM signal

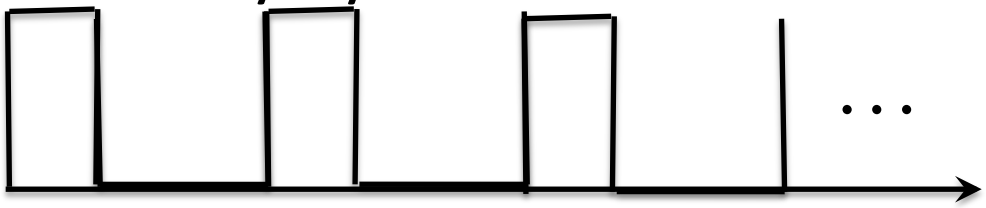


Pulse Width Modulation

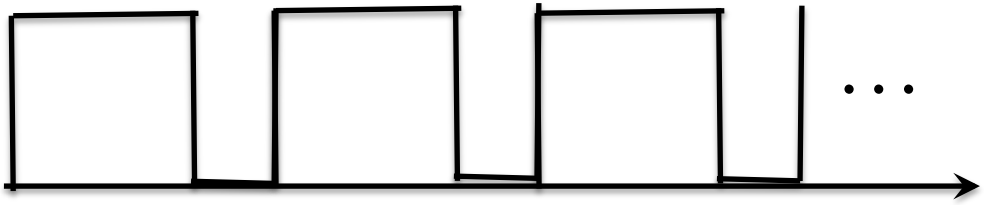
- 50% Duty Cycle



- 25% Duty Cycle



- 75% Duty Cycle



- 100% Duty Cycle

- PWM is a (approximately) 490 Hz square wave where a portion (percentage) of the signal is high while the remainder of the signal is low.
- The percentage of the high portion is called the Duty Cycle.