



CS250 – Lab Kit visual BOM

Semester Week 01
Spring 2018
Purdue University

Electrical circuit elements

1. Electrical energy sources (measured with voltage and current)
 2. Devices to **transport, modify, transform, and control** electrical energy
- Using your lab kits, you will work with
- 1 USB port [**convenient source of 5V electrical energy**]
 - about 10 feet of wire and 5 switches [**transport**]
 - 20 Resistors [**modify: dissipate energy**]
 - 2 Capacitors [**modify: store and release charge**]
 - 9 Light-emitting diodes (LEDs) [**transform: to photons**]
 - and, literally, billions of transistors
[**control: switch on and off the paths to pools of electrons of different voltage energy levels**]

What does the lab kit enable?

■ Hardware (HW)

Exploration of Boolean logic circuits

- What is our computing platform built from?
- How does this technology behave?
- What can we ask and not ask of it?

■ Software (SW)

Programming the “bare metal” of a computer

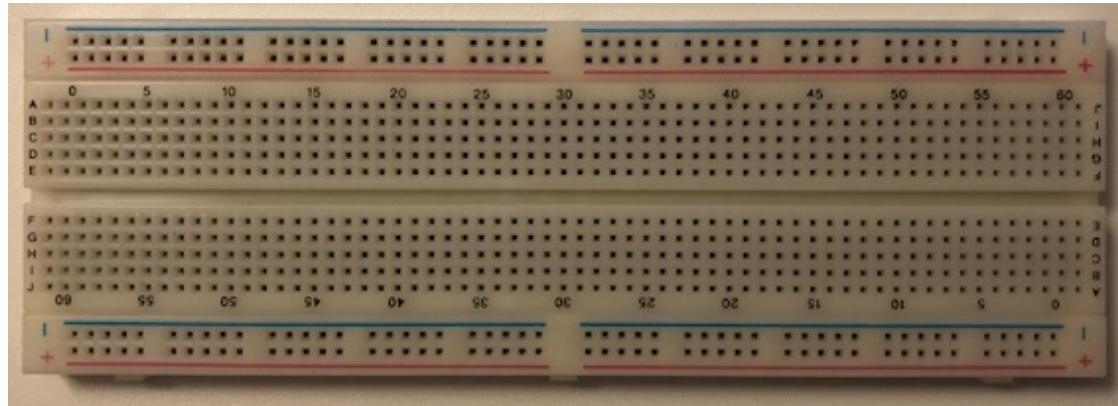
- What does the meeting of software with hardware look like?
- What are the considerations?

BOM – bill of materials

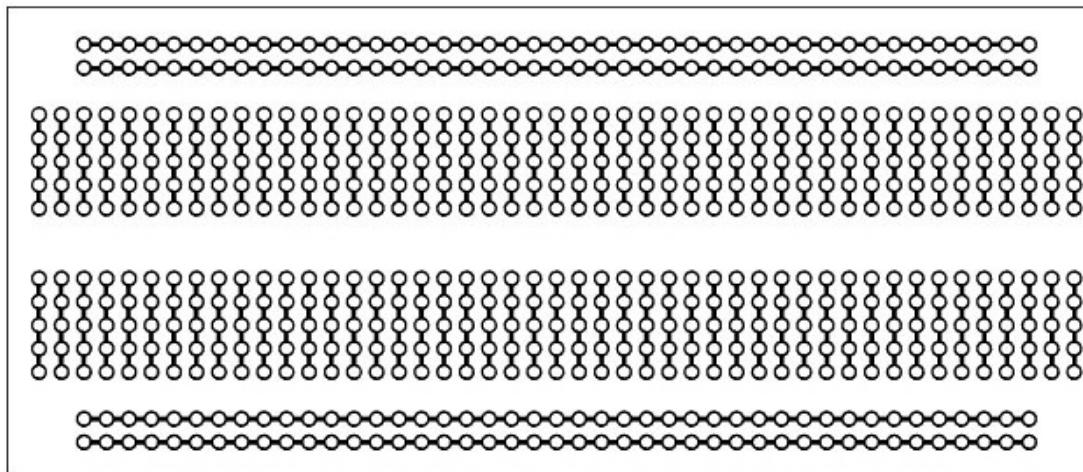
- Bill of materials (BOM) – a list of the raw materials, sub-assemblies, and/or parts and the quantities of each needed to manufacture an end product
- The following slides provide a visual BOM of the contents of your lab kit

Breadboard – platform for circuit building

- Devices and wires plug into the breadboard



- Connections between the tie points (see textbook page 446 for more information)



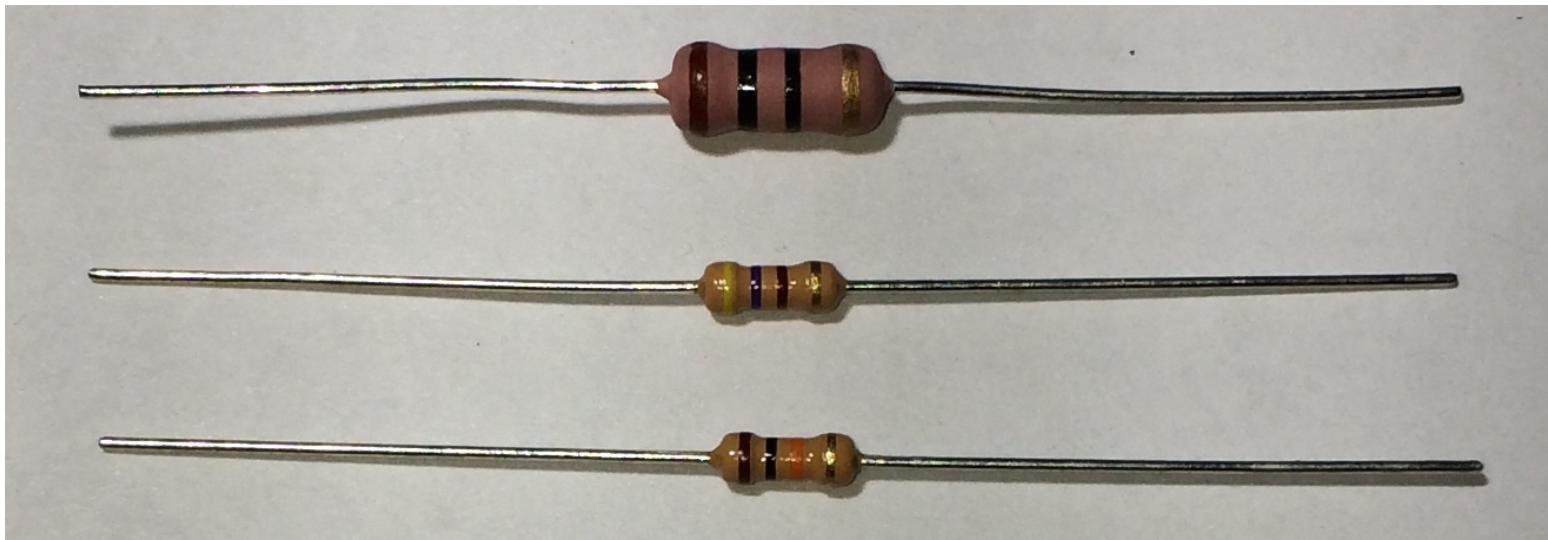
USB console cable for breadboard power

- Breaks out the 4 wires of a USB cable by function
 - White & green wires together deliver 1 data bit
 - Red & black are +5 volts and ground, respectively
- Used to deliver 5 volts and up to 0.5 amps to circuits on the breadboard



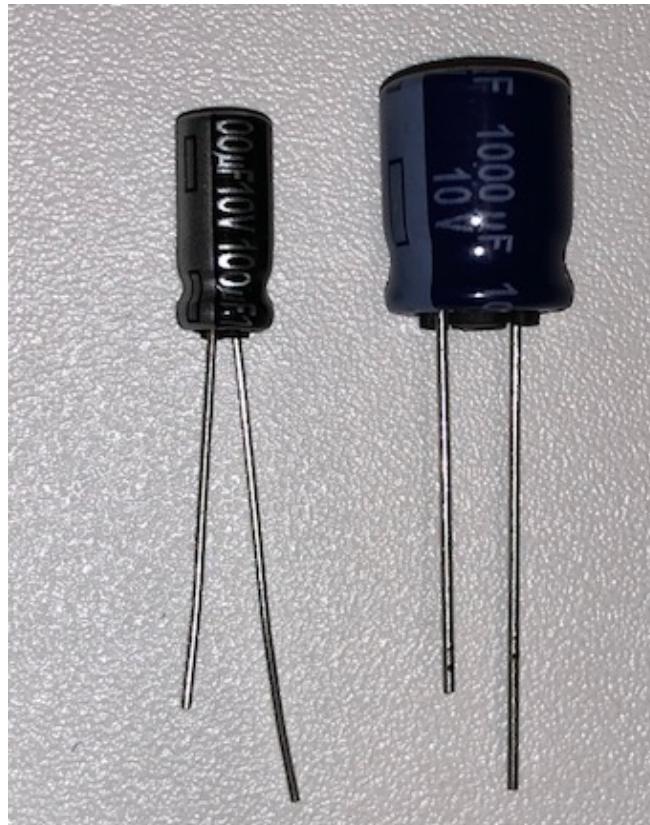
Resistors $10\ \Omega$ (ohms), $470\ \Omega$, and $10\ K\Omega$

- Three color bands encode resistance, fourth encodes value tolerance; size encodes heat dissipation ability
 - (Quantity 1) Brown, Black, Black, Gold means $10 \times 10^0 \pm 5\% = 10 \pm 0.5\ \Omega$ and size permits heat dissipation of up to 2 Watts
 - (Quantity 10) Yellow, Purple, Brown, Gold = $47 \times 10^1 \pm 5\% = 470 \pm 23.5\ \Omega$ and smaller size permits heat dissipation of up to $\frac{1}{4}$ Watt
 - (Quant. 10) Brown, Black, Orange, Gold = $10 \times 10^3 \pm 5\% = 10,000 \pm 500\ \Omega$
- Used to change voltage



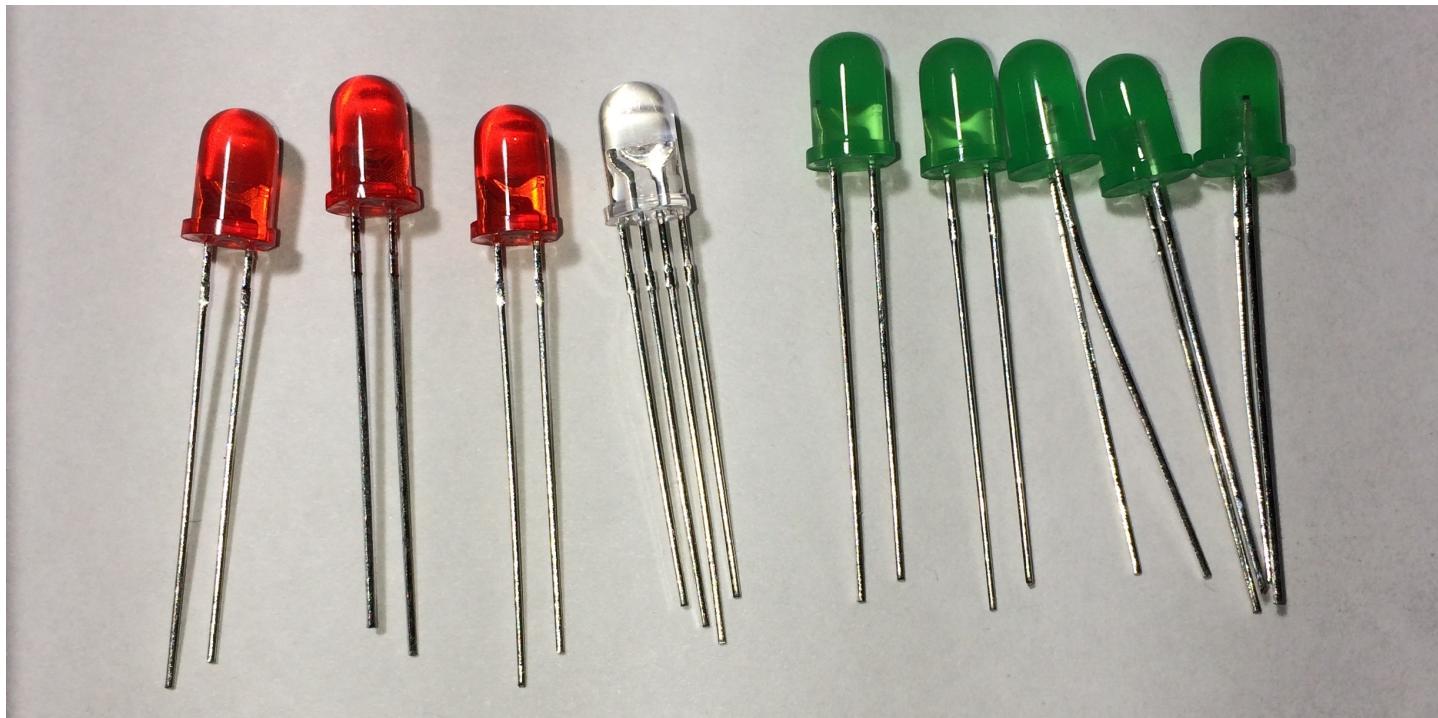
Capacitors: $100\mu\text{F}$ (micro-Farads) and $1000\mu\text{F}$

- Stores energy in the form of an electric field
- Voltage between the two leads (wires sticking out) increases with increased stored energy



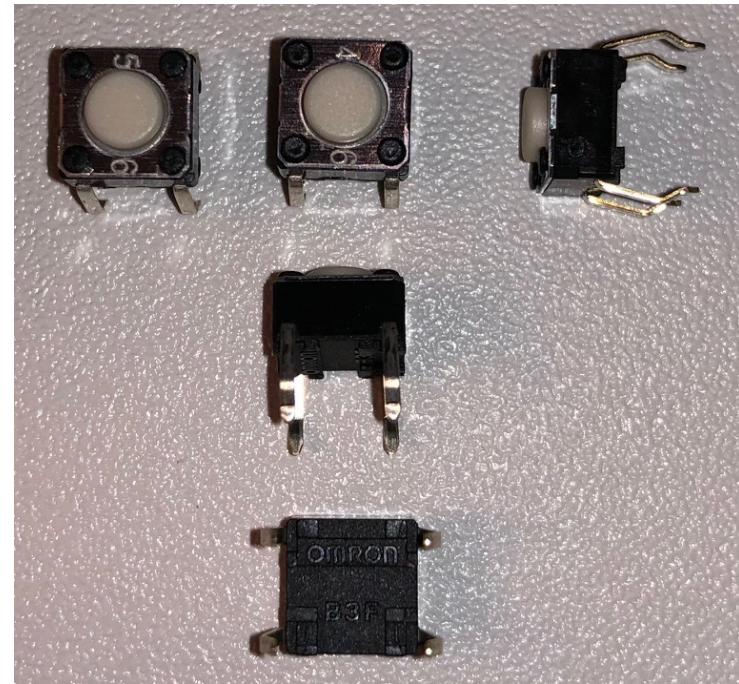
Light-emitting diodes (LEDs)

- Red, clear is 3-in-1 tri-color (RGB), and green
- Used to output computational results and for `printf()`-style debugging of hardware circuit



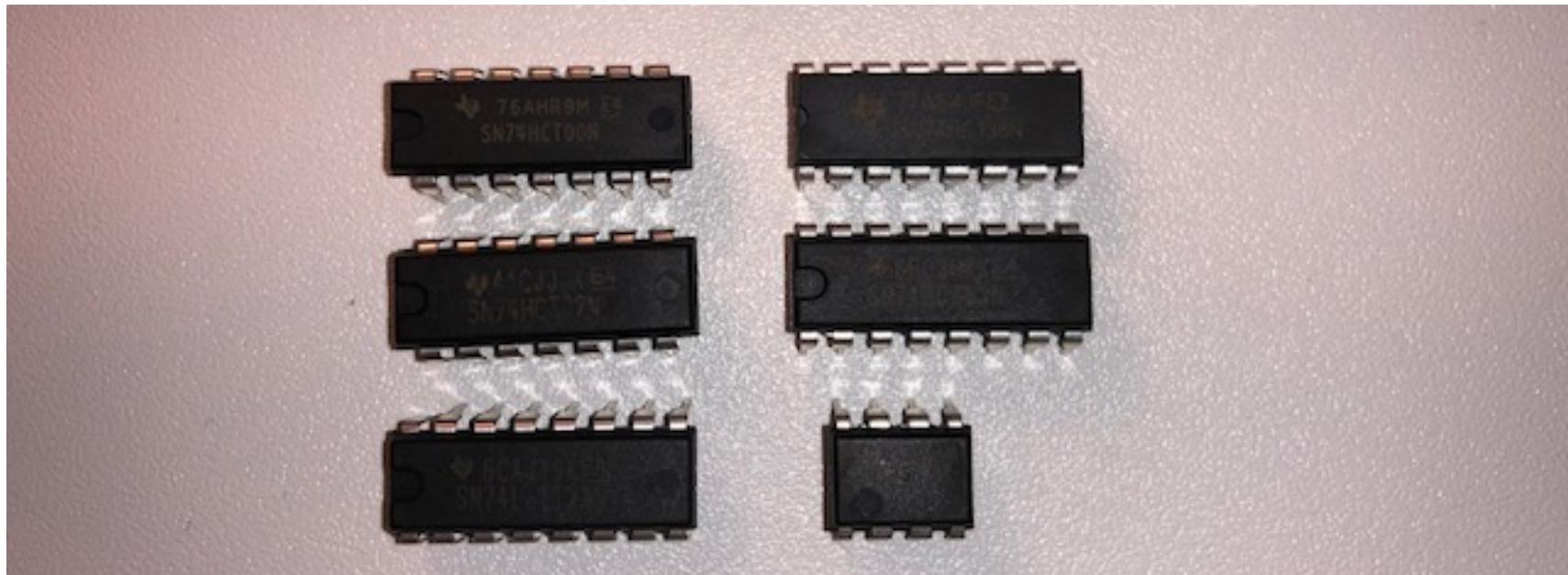
Switch of type haptic pushbutton, SPST-NO

- Haptic pushbutton = switch gives operational feedback via the sense of touch when the button is pushed
- SPST-NO = single pole /single throw topological electrical contact configuration that is “normally” open
 - normal = button not being pushed
 - open = no electrical connection between switch terminals
- Used in conjunction with a resistor to input one bit of data to a logic circuit



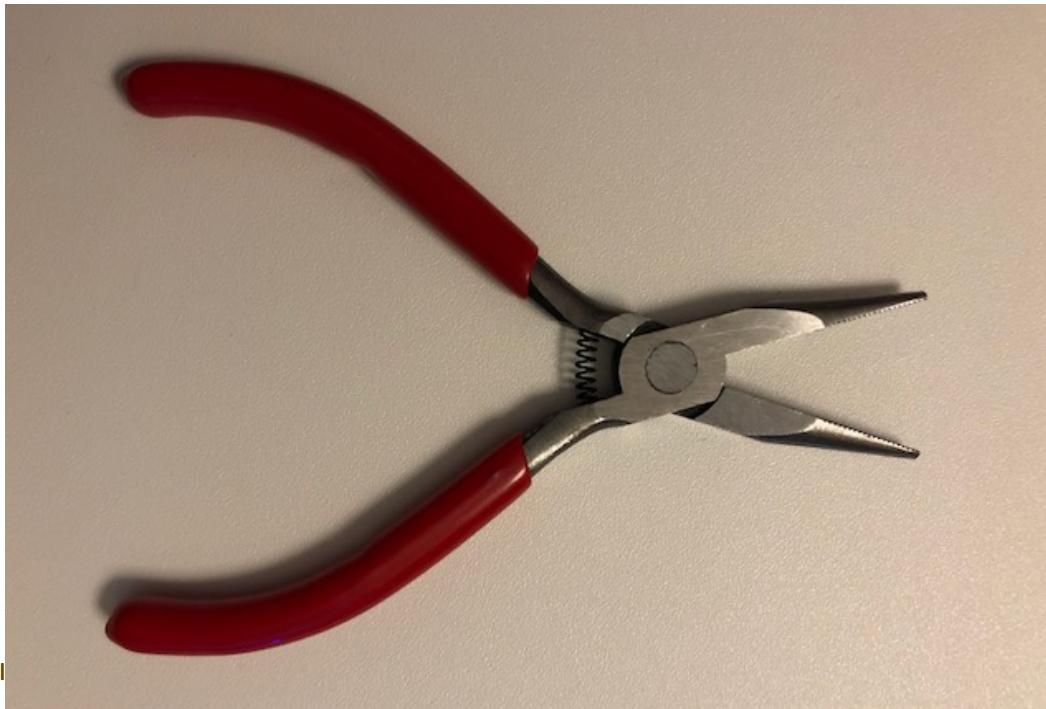
Integrated circuits (ICs)

- Contain logic gates and basic building block circuits for digital computers
- 2 more SN74HTC00N chips are on backorder; they will be distributed in a lab to follow



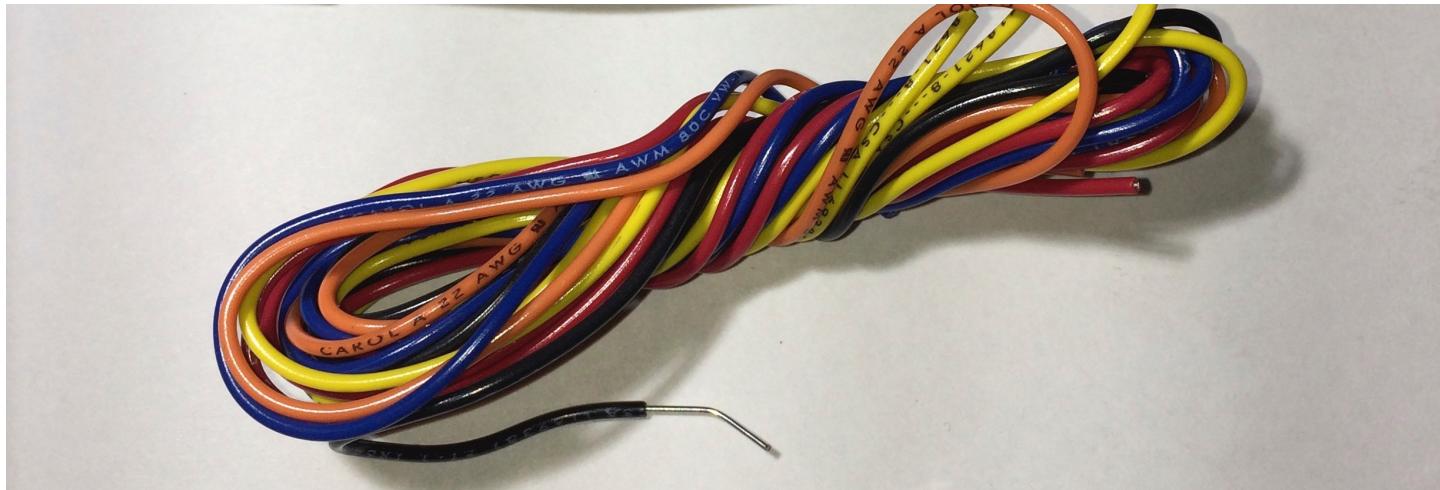
Needle nose pliers

- Used as a supplement to / in addition to fingers to insert/remove items from the breadboard
- Used to straighten bent IC pins



Hookup wire (available in lab when needed)

- Copper wire with colorful plastic insulation
- Used to connect devices on the breadboard
(not part of your lab kit)
- Available in lab at self-serve station in the back



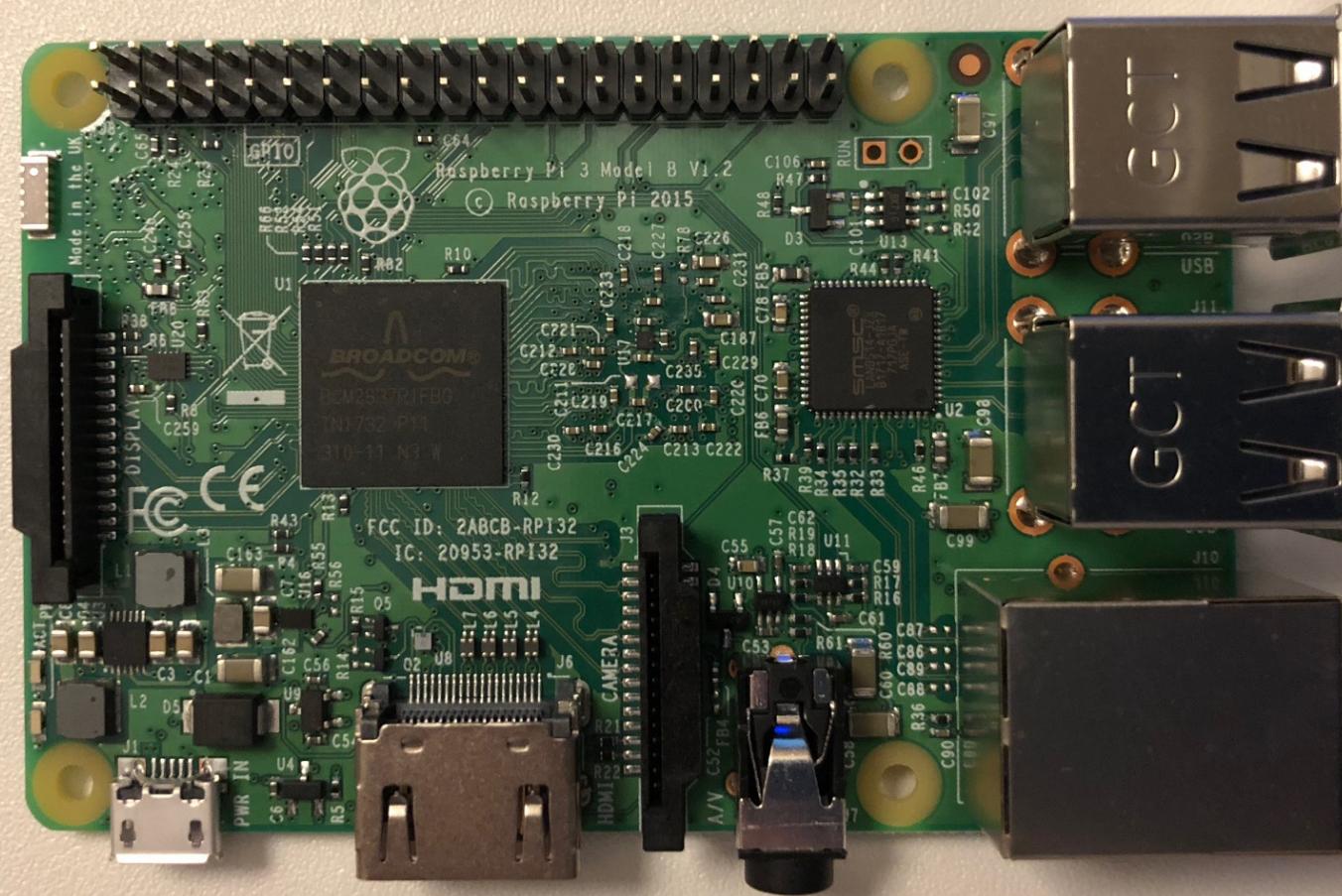
Wire cutter and stripper

- Used to cut hookup wire and to remove plastic insulation from hookup wire ends



Raspberry Pi 3 Model B V1.2 computer

■ Single-board computer



microSD card and SD form factor adaptor

- microSD card (left item in photo) stores Raspbian O/S for Pi and the user file system
- SD physical format adaptor allows easy use of microSD card with original SD-size ports



Physical handling of the Raspberry Pi

- Treat your Pi gently and it will work indefinitely long, however, excessive force can render your Pi inoperative, e.g.,
 - Pushing hard on an inserted microSD card can break the connection from the card to the Pi
 - Bending the Pi can crack wires within its circuit board, breaking needed connections
- The Pi has many uninsulated exposed points on its circuit board, prevent them from touching metal
 - Do not place your Pi on a metal surface, causing addition of a perhaps damaging electrical connection among the Pi components
 - Do not allow small metal parts, hookup wire clippings, and the like to fall onto your Pi

Flash drive for backup of Pi microSD card

- Use this flash drive to make regular backup of all the software on the microSD card of your Raspberry Pi computer



USB to micro USB cable 5 volt power

- Used to power the Raspberry Pi from a standard USB port



Jumpers – to connect Pi with breadboard



End of BOM
