Basic Electronics

- Simple circuits
- Simple rules
- Bench top equipment
RC CIRCUITS

- Circuit with a power source and:
  - A resistor
  - A capacitor
- In series or in parallel
RESISTOR

- A two-terminal electronic component that produces a voltage across its terminals that is proportional to the electronic current passing through it.

\[ R_{eq} = R_1 + R_2 + \cdots + R_n \]

\[ \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n} \]
CAPACITORS

- Capacitors are two conductors separated by an insulator (dielectric)

- Capacitors charge up or discharge
**Ohm’s Law**

- $V = IR$
  - Voltage = Current * Resistance
Voltage Divider

One way of changing the supply voltage of a battery.

\[ V_{out} = \frac{R_2}{R_1 + R_2} \cdot V_{in} \]
LAB EQUIPMENT

- Digital Multimeter
  - Measures things
  - Voltage
  - Current
  - Resistance
  - AC/DC
Binary Addition and Half-Adder

- $0 + 0 = 0$
- $0 + 1 = 1$
- $1 + 0 = 1$
- $1 + 1 = \ldots$

A half-adder can add 2 bits and produces a sum and carry signal

- **Sum** = $A \text{ xor } B$
- **Carry** = $AB$

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<th>B</th>
<th>C</th>
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### One-Bit Full Adder

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<th>A</th>
<th>B</th>
<th>C&lt;sub&gt;in&lt;/sub&gt;</th>
<th>C&lt;sub&gt;out&lt;/sub&gt;</th>
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The diagram on the right illustrates the logic gates representing the one-bit full adder. The inputs A and B are connected to the first two gates, and C<sub>in</sub> is connected to the third gate. The outputs C<sub>out</sub> and S are shown at the lower end of the circuit.
FOUR-BIT FULL ADDER

Ripple-carry adder