EECS 16A Designing Information Devices and Systems I
Spring 2015 Discussion 2W

Charge

- Unit of charge is Coulomb.
- Charge can either be positive or negative.
- Charge of an electron is $e = 1.6 \times 10^{-19}$C.
- Law of conservation of charge: charge can neither be created nor destroyed.

Current

- Current is the rate of change of charge through a surface.
- Unit of current is Coulomb/sec which is Ampere.
- A “positive" current flows into the positive terminal of a resistor.
- KCL: From the principle of conservation of charge “At any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node".

Voltage

- Voltage between two nodes (A and B) is the amount of energy spent/gained to move a unit charge from point A to B.
- Unit of voltage is Volts.
- Voltage is always relative.
- Ohm’s law: $V = IR$.
- KVL: From the principle of conservation of energy “The directed sum of the electrical potential differences (voltage) around any closed network is zero".

Series and Parallel resistance connections

- Series: Current through the two resistors is the same (ask why?), then use KVL and Ohm’s law. Point out that net resistance increases.
- Parallel: Voltage difference across both resistors is the same (ask why?), then use KCL and Ohm’s law. Point out that the net resistance is smaller than the smallest resistance.

Measuring Voltage and Current

- Measuring Voltage: Voltage between two nodes is to be measured. So the measuring device is connected in “parallel" to the two nodes. Voltmeter should measure voltage without drawing current. Ask why and what should be the resistance of a voltmeter? Connect here to problem in homework 0.
- Measuring Current: Current through a circuit is the be measured. So the measuring device is connected in the path of the current. Ammeter should measure current without having a voltage drop across it. Ask why and then ask what should be the resistance of an ammeter?

Diodes

Draw the circuit that they will build in lab 1.

- Qualitatively realize that without a capacitor, the variation in light would directly show up as variation in voltage.
- Once the capacitor is added, in order for the current in the resistor to change, the voltage across needs to change, but this can’t happen unless the charge in the capacitor changes.
- This implies that the initial change in current has to flow through the cap to charge/discharge it; if the total charge contained in that variation in current is small (relative to the charge already on the cap), it can’t change the voltage very much (why? because $Q = CV$) - we you get the smoothing/averaging.

Bunny and the Beach blending

- Consider a grayscale image where each pixel only represents the intensity of light; varying from black at the weakest intensity to white at the strongest.
- Assume that intensity of each pixel is a real number. Black being numbers closers to zero and white are large numbers.
- What happens when an image is “scaled"?
- What happens when two images are “added"? How can we think about it?