Introductory Concepts and Tools
Computer Science 240

Laboratory 1

- Administrivia
- Lab Environment
- Basic Electronics (Ohm's law, transistors, logic gates)
- Linux (open source UNIX operating system)
- C (language) and Emacs (editor for creating programs)
- Bitbucket and Mercurial (source control applications to manage and share your work)

Lab Environment

- All lab exercises and reports will be *Google Docs*, and should be shared with lab partner and the instructor
- Bring a laptop to lab if you have it (helpful to use a second computer for the lab report)
- From lab machine booted to Linux, you can enter Linux commands using a **terminal/shell**
- You can also use a terminal from either Mac (*Terminal*) or PC (*PuTTY*) to open a remote connection to a Linux machine for command-line entry

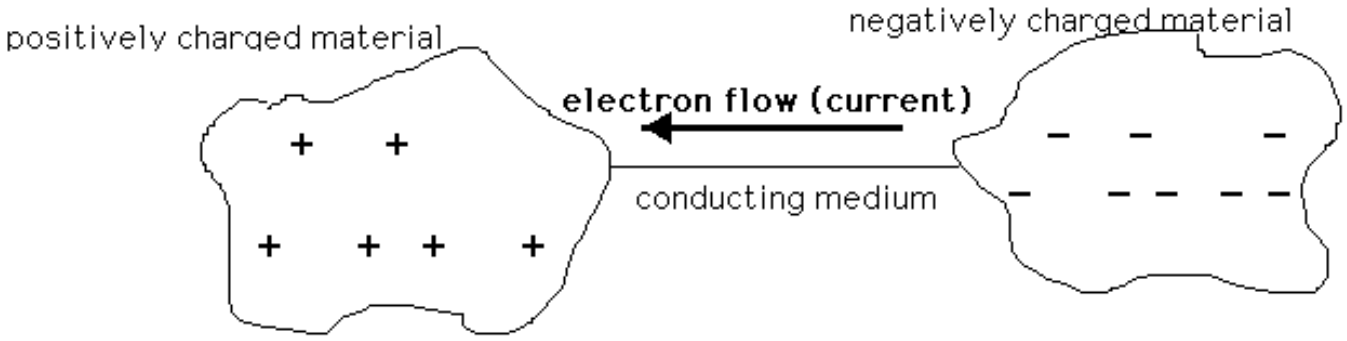
NOTE: for some exercises and assignments, you will be required to use the lab machines to compile and run your programs

Basic Concepts of Electricity

Electricity = **the movement of electrons** in a material

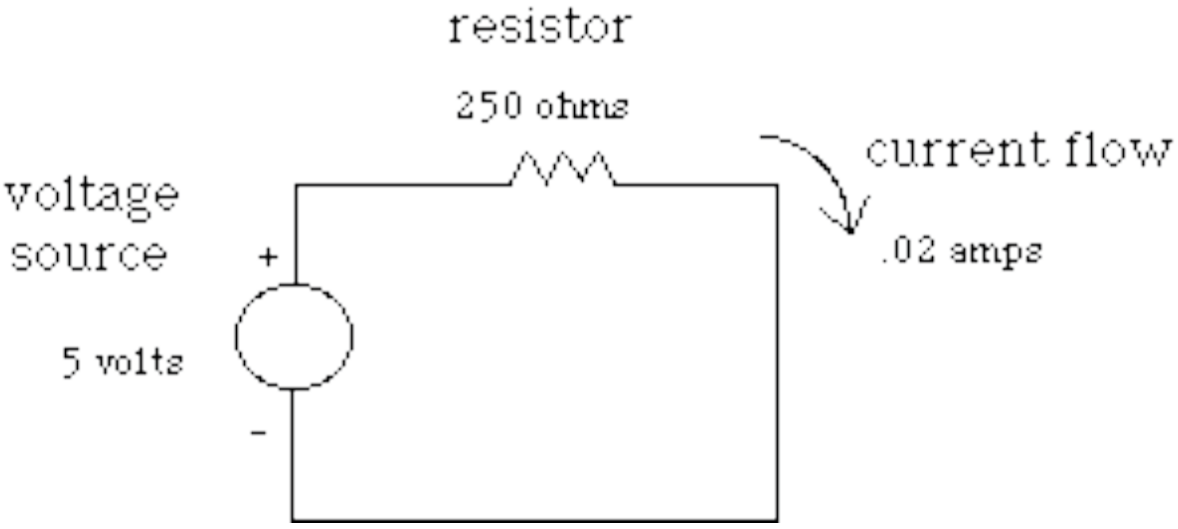
Materials tend to have a net negative or positive charge

Difference of charge between two points = **potential difference (V)**



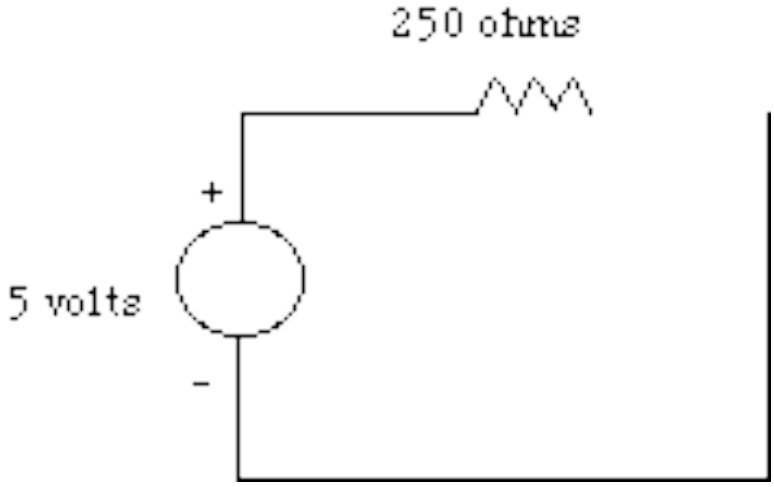
Rate at which electrons flow through = **current (A)**.

Ease of conduction, or current flow = **resistance (Ω)**

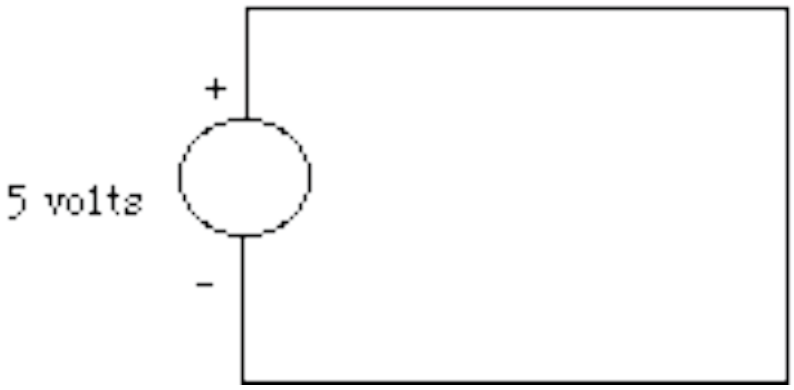


Ohm's Law, V = IR.

Open circuit = no current

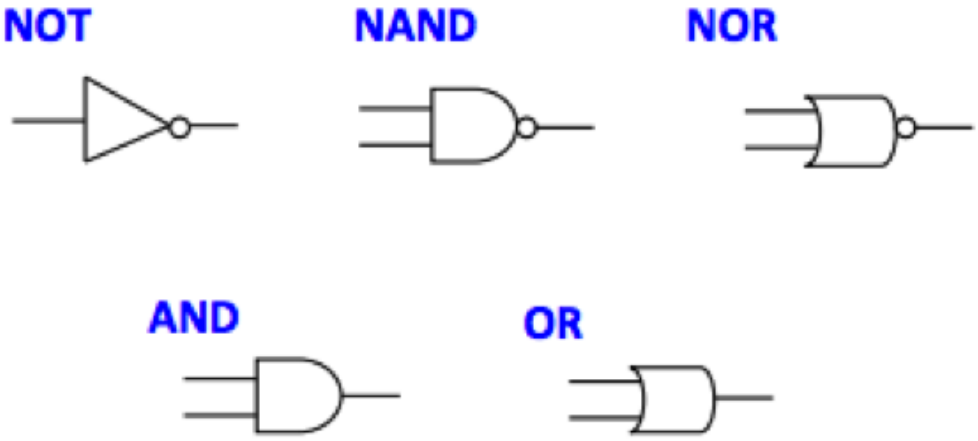


Short circuit = infinite current, since V/0 = infinite current:



Infinite current swiftly results in the destruction of the circuit!

Basic Gate Symbols



Notation and Truth Tables for Basic Logic Gates

NOT **F = A′**

A	F
0	1
1	0

NAND **F = (AB)′**

A	B	F
0	0	1
0	1	1
1	0	1
1	1	0

NOR **F = (A+B)′**

A	B	F
0	0	1
0	1	0
1	0	0
1	1	0

AND **F = AB**

A	B	F
0	0	0
0	1	0
1	0	0
1	1	1

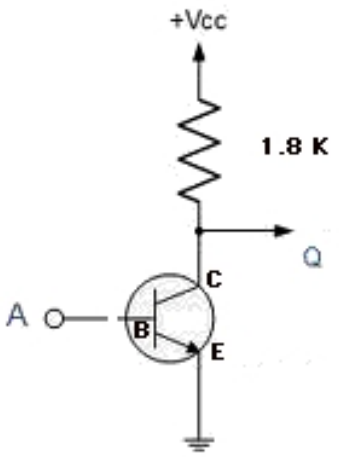
OR **F = A + B**

A	B	F
0	0	0
0	1	1
1	0	1
1	1	1

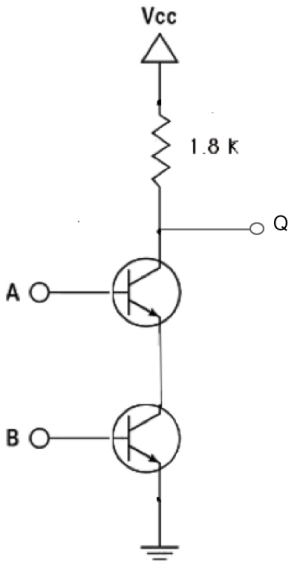
Basic Gates are built using Transistors

You have seen the circuits for NOT and NAND in lecture:

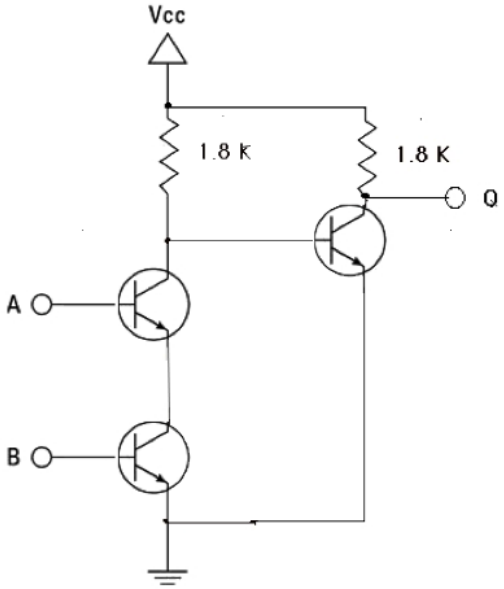
NOT – 1 transistor



NAND - 2 transistors

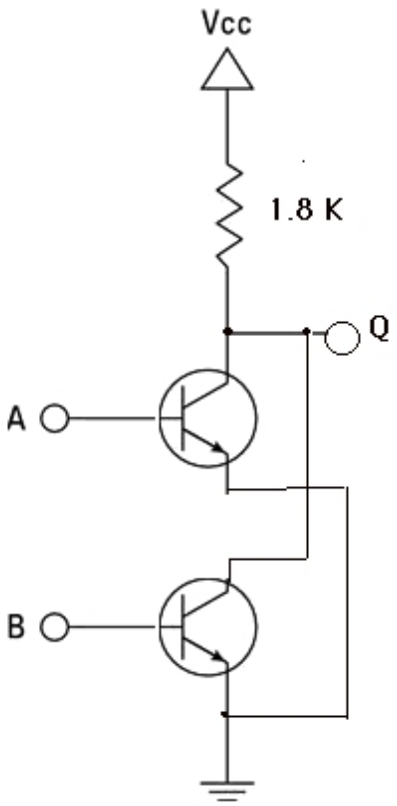


AND – uses 3 transistors (send the output of a NAND through another transistor acting as a NOT gate to complement the result):

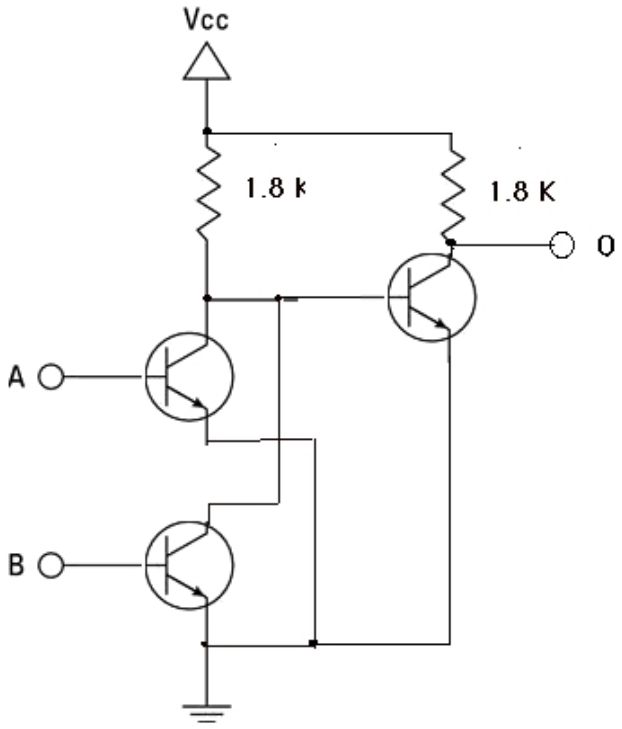


Similarly, these are the transistor circuits for a NOR and OR gate:

NOR – 2 transistors

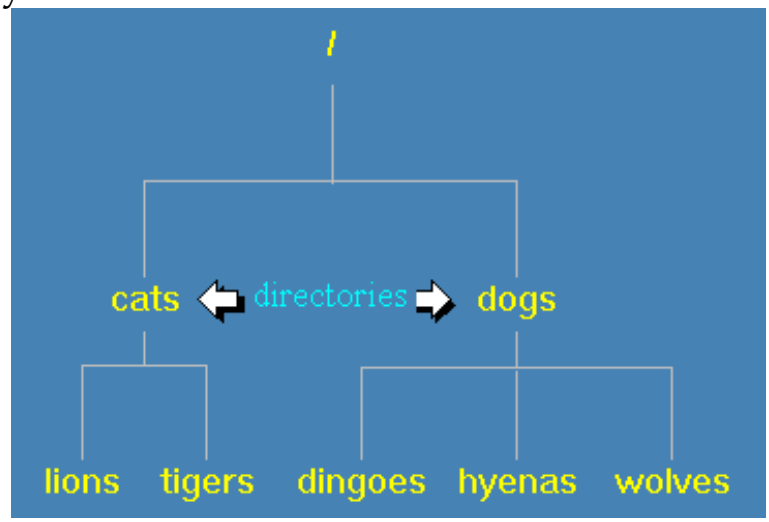


OR – 3 transistors



Linux

- Filesystem



- **/** (*root directory)*
- **./** (*working directory)*
- **../** (*up one levels from working directory)*
- **pwd** (*print working directory)*
- **cd** (*change working directory)*
- **ls** (*list files and folders)*
- **ls –l** (*list files and folders with more information)*
- **ls –a** (*list all files and folders)*
- **mv** (*rename)*
- **cp** (*copy)*
- **rm** (*remove)*
- **mkdir** (*create directory)*
- **rmdir** (*remove directory)*
- **diff** (*difference between two files)*
- **grep** (*search)*
- **echo** (*echo to terminal)*
- **cat** (*concatenate)*
- **>** (*redirect*)
- **gcc -Wall -g --std=c99 -o flnm flnm.c** (*compile C program)*
- **make** (*compile using **Makefile** in working directory*)
- **./flnm** (*run executable program named* flnm)

C programming language

- Basic syntax quite similar to Java and Python
- Some key differences:
  - No objects
  - Everything is a function
  - Begin execution at **main( )**
  - Does not have a **boolean** data type

```
/* CS 240: A simple first C program. */

/* Import definitions of standard library functions. */
#include <stdlib.h>

/* Import definitions of standard library input and output functions. */
#include <stdio.h>

/* The main function is called when the program is executed.
   Its return value is the exit status of the program.
   (0 = success, anything else = error)

   argc: number of command line arguments
   argv: array of string arguments (ignore "char**" for now)  */

int main(int argc, char** argv) {
  // Print "Hello, Jean!" to standard output.
  printf("Hello, Jean!\n");
  // Exit with success.
  return 0;
}
```

- **printf** and **scanf** (formatted I/O)

```
// Prompt for and read in an integer variable
int x;
printf("Enter a positive integer: ");
scanf("%d",&x);
printf("The value is = %d",x);
```

Bitbucket/Mercurial

Manage course materials and student individual/team work. Focus on individual workflow for today.

- Bitbucket (cloud/server):
  - fork repositoryname
  - change permissions/share using menu interface
- Mercurial (local/client) command-line interface:
  - **hg help**
  - **hg clone bitbucketrepository**
  - **hg add**
  - **hg commit**
  - **hg status**
  - **hg push**
  - **hg log**
  - **hg serve**
  - **hg revert**
  - **hg rename**
  - **hg mv**
  - **hg pull**
  - **hg push**
  - **hg update**
  - **hg incoming**
  - **hg merge**
  - **hg resolve**