

Introductory Concepts and Tools

Computer Science 240

Laboratory 1

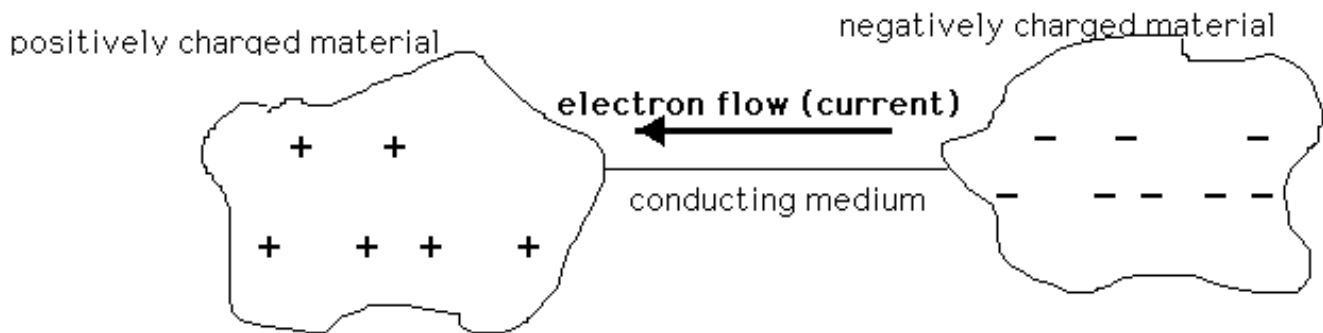
- Administrivia
- Basic Electronics
- Linux (open source UNIX operating system)
- Emacs (editor for creating programs)
- C (programming language)
- Bitbucket and Mercurial (source control applications to manage and share your work)

Basic Concepts of Electricity

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

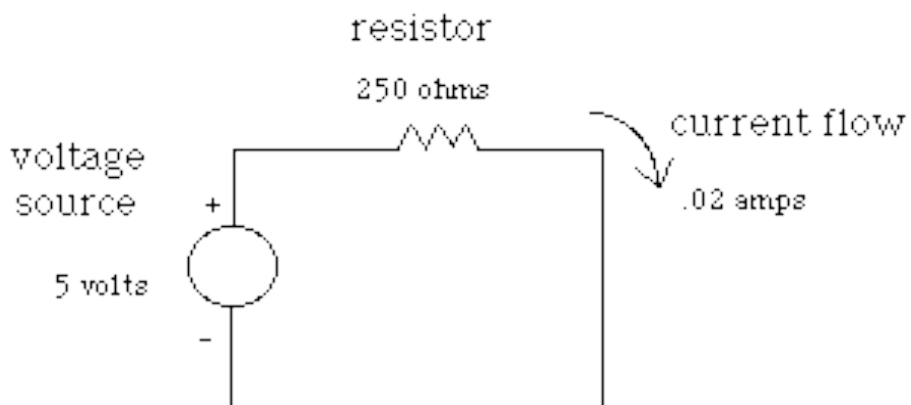
Materials tend to have a net negative or positive charge

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



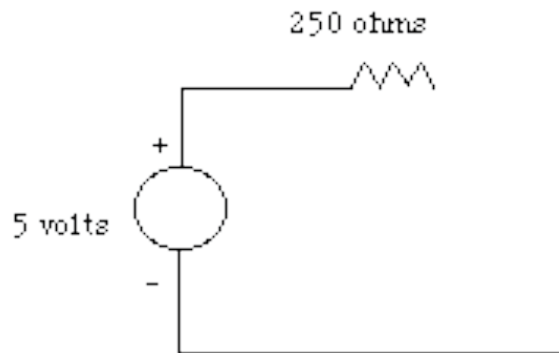
Rate at which electrons flow through = **current (A)**.

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

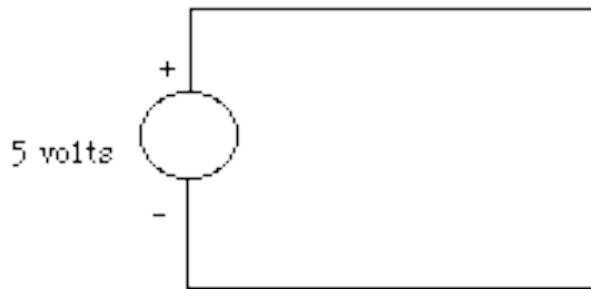


Ohm's Law, $V = IR$.

Open circuit = no current

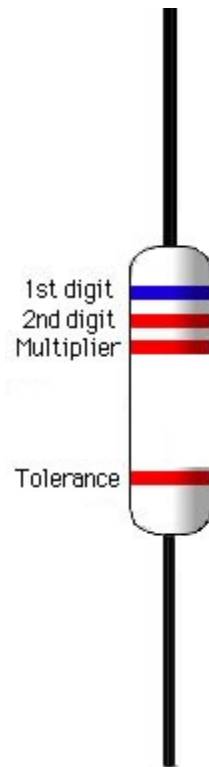


Short circuit = infinite current, since $V/0 = \text{infinite current}$:



Infinite current swiftly results in the destruction of the circuit!

Resistor Color Codes



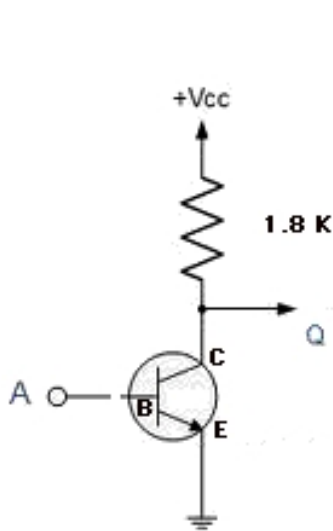
<u>color</u>	<u>digit</u>	<u>multiplier</u>
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1000 (1K)
Yellow	4	10000 (10K)
Green	5	100000 (100K)
Blue	6	1000000 (1M)
Violet	7	10000000 (10M)
Gray	8	
White	9	

Transistors

You saw the circuits for NAND in lecture.

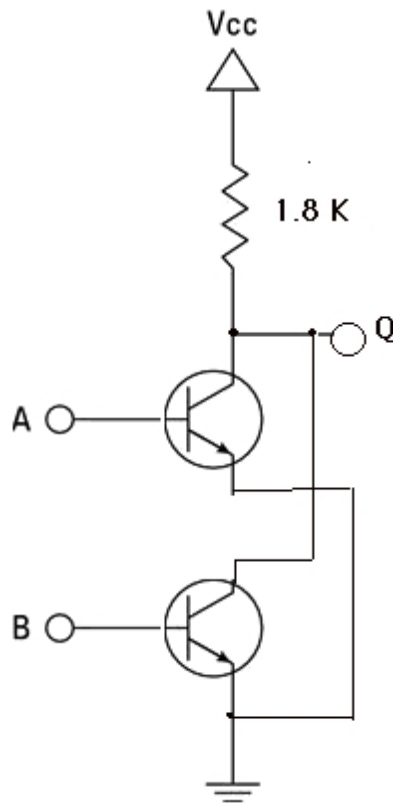
NOT

Uses 1 transistor



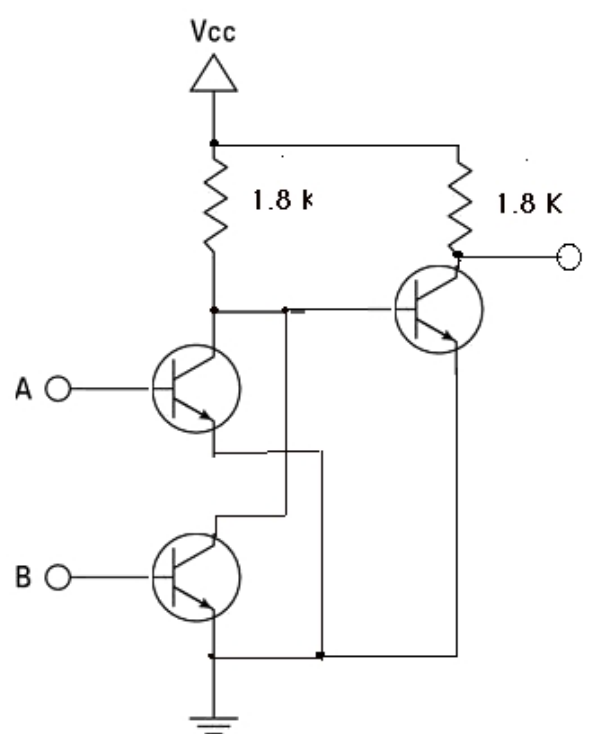
NOR

Uses 2 transistors



OR

Uses 3 transistors



Five basic gates

NOT



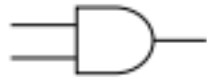
NAND



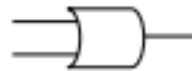
NOR



AND



OR



Truth Tables

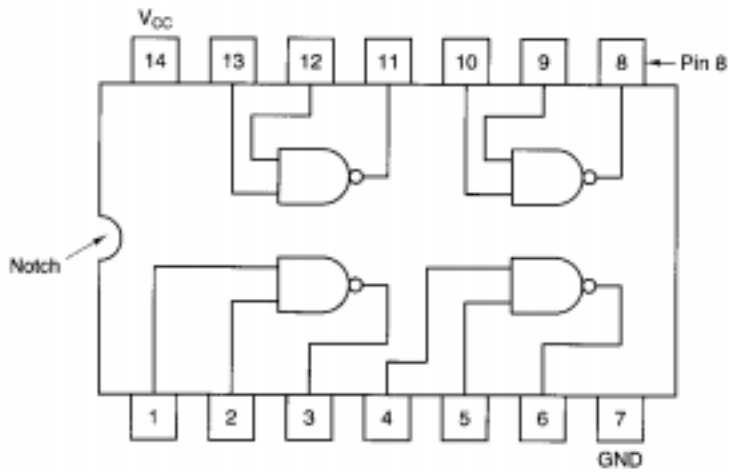
Given a function: $F = A + B$

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

You can build a circuit for any given function, using NOT, AND, and OR gates (or using only NAND, or only NOR, gates).

Functions are equivalent if they produce the same truth table.

Integrated Circuit (IC) or chip



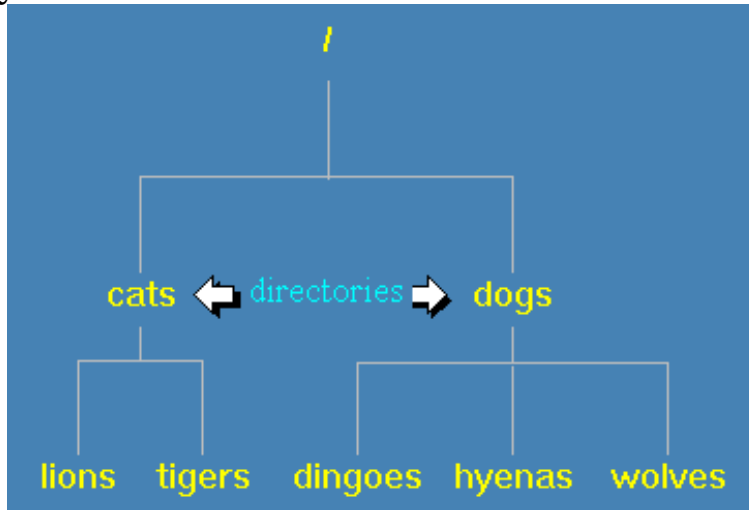
We will build some simple circuits in lab on a protoboard, using chips.

Lab Environment

- Bring a laptop to lab if you have it (helpful to have a second computer)
- Command-line entry using a terminal / shell
- From Mac, underlying operating system is UNIX, so easy to open terminal and work at command-line
- From PC, you can open a remote connection to a Linux machine for a similar environment
- NOTE: for some exercises and assignments, you will be required to use the lab machines to compile and run your programs

Linux

- Filesystem



- /
- ./
- ../
- pwd
- cd
- ls
- ls -l
- ls -a
- mv
- cp
- rm
- mkdir
- rmdir
- diff
- grep
- echo
- cat
- > (redirection)
- gcc -g -o filename filename.c (compile)
- make (compile, uses Makefile in working directory)
- ./filename (to execute)

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