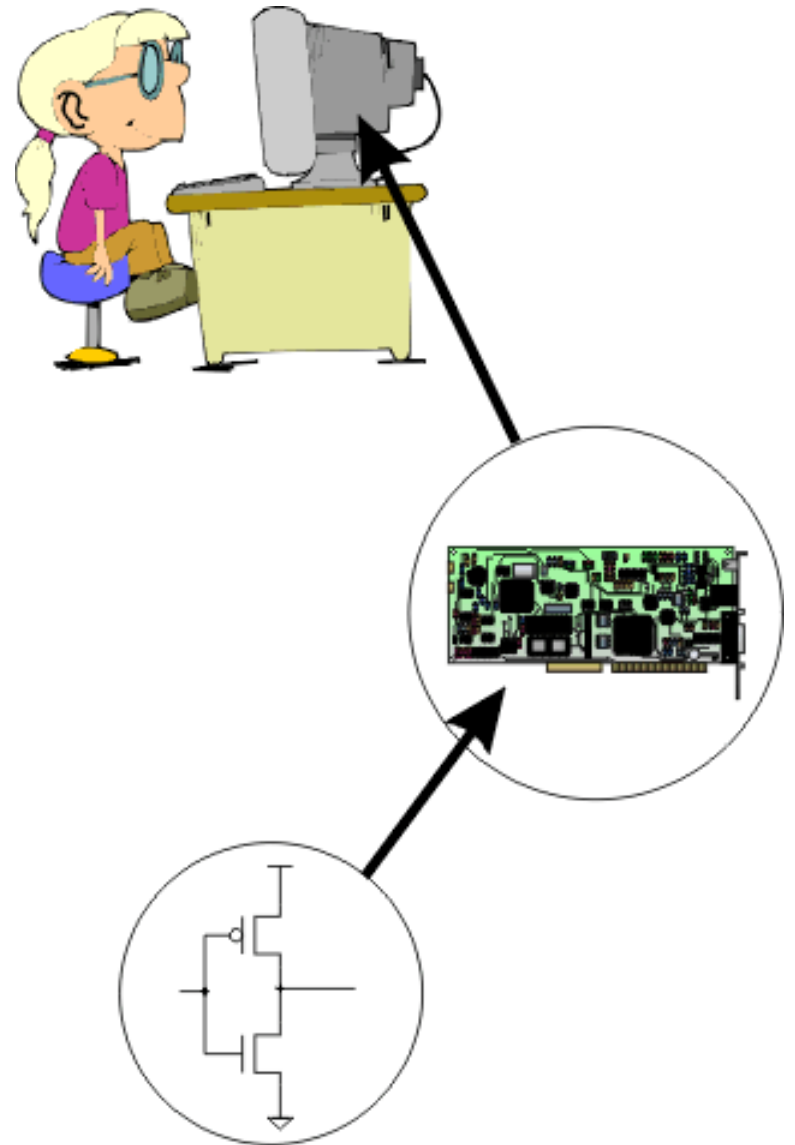


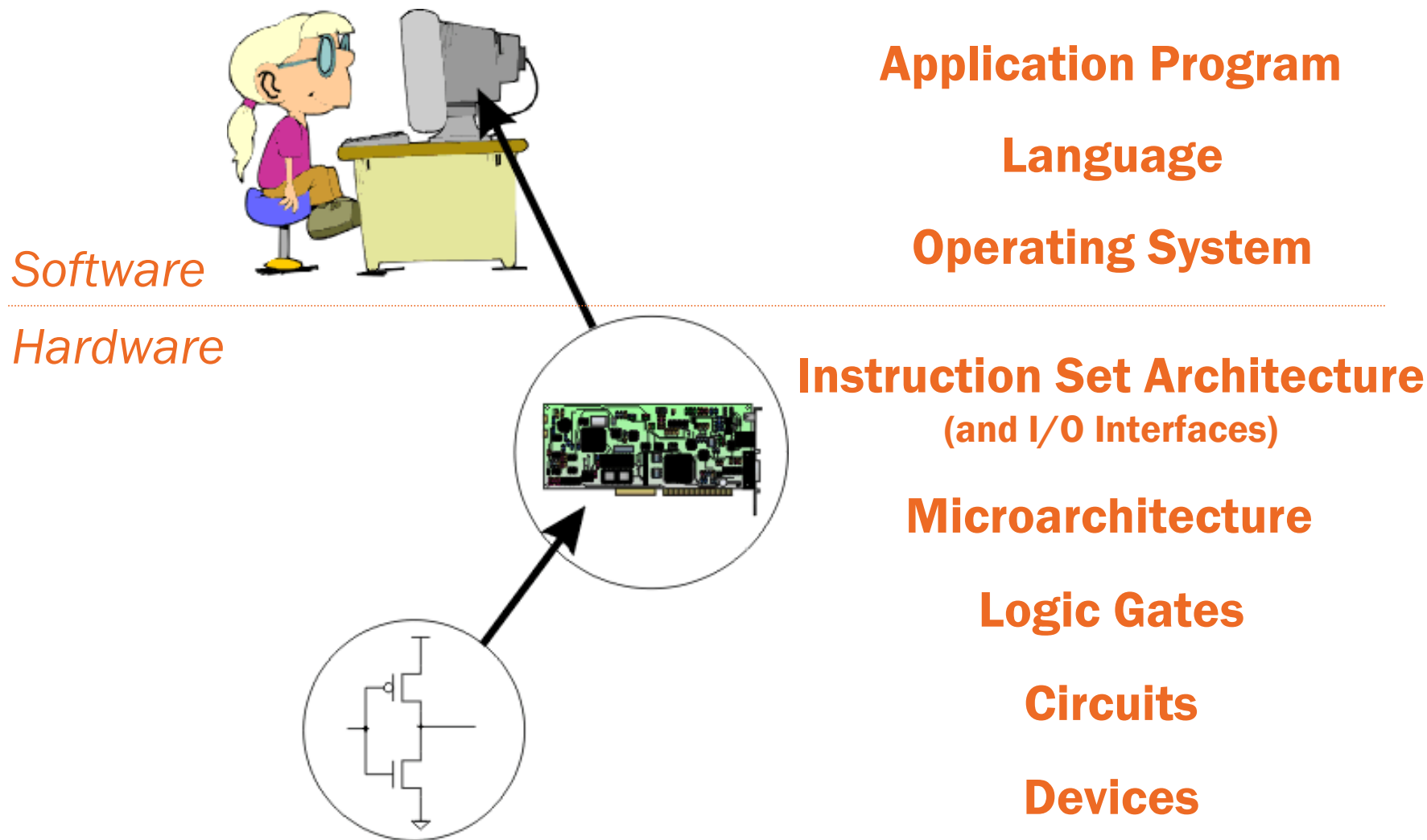
# Introduction to Digital Logic

ECGR2181  
Lecture Notes 1

*Reading:* syllabus, Chapter 1



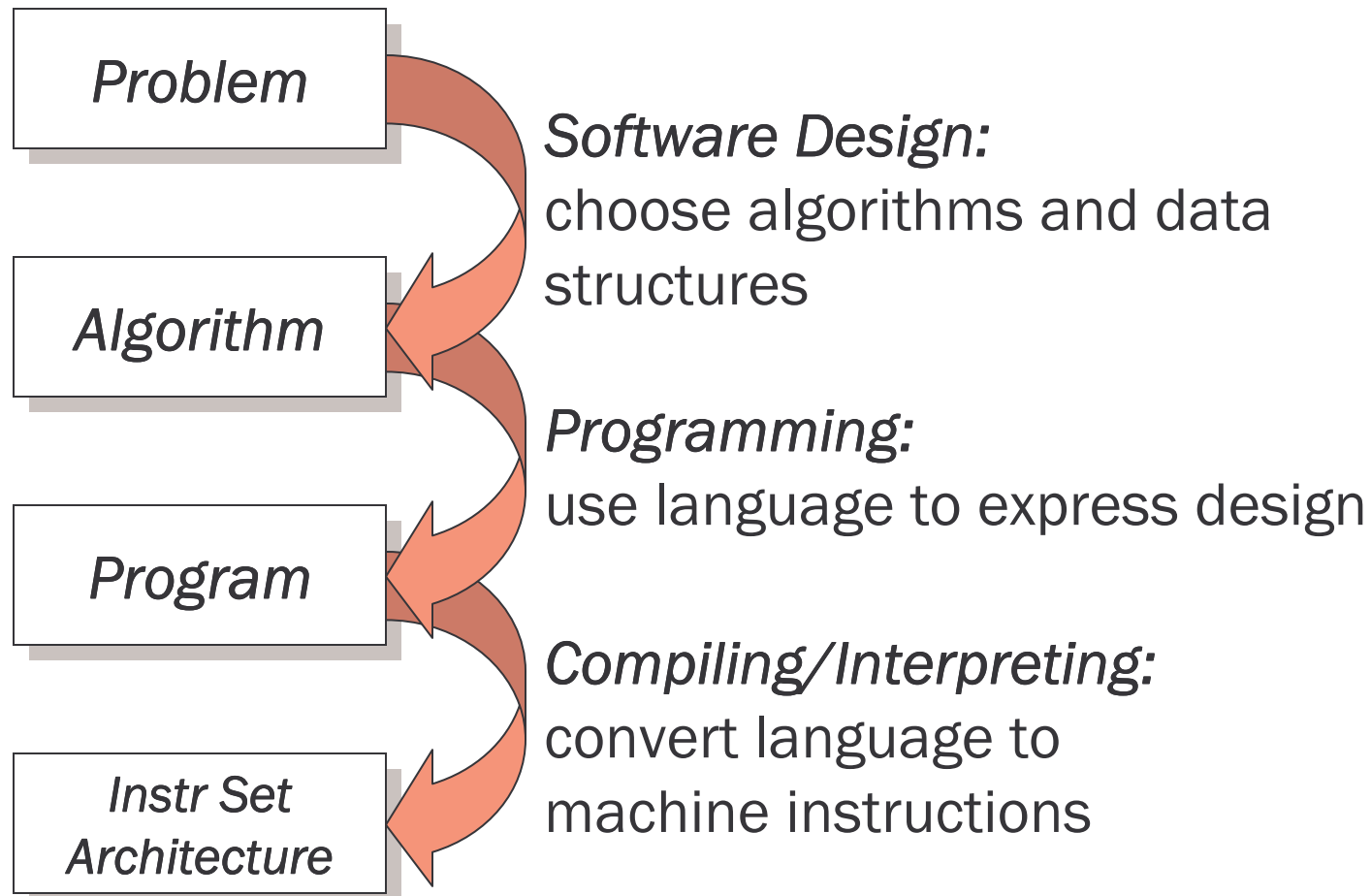
# Computer System: Layers of Abstraction



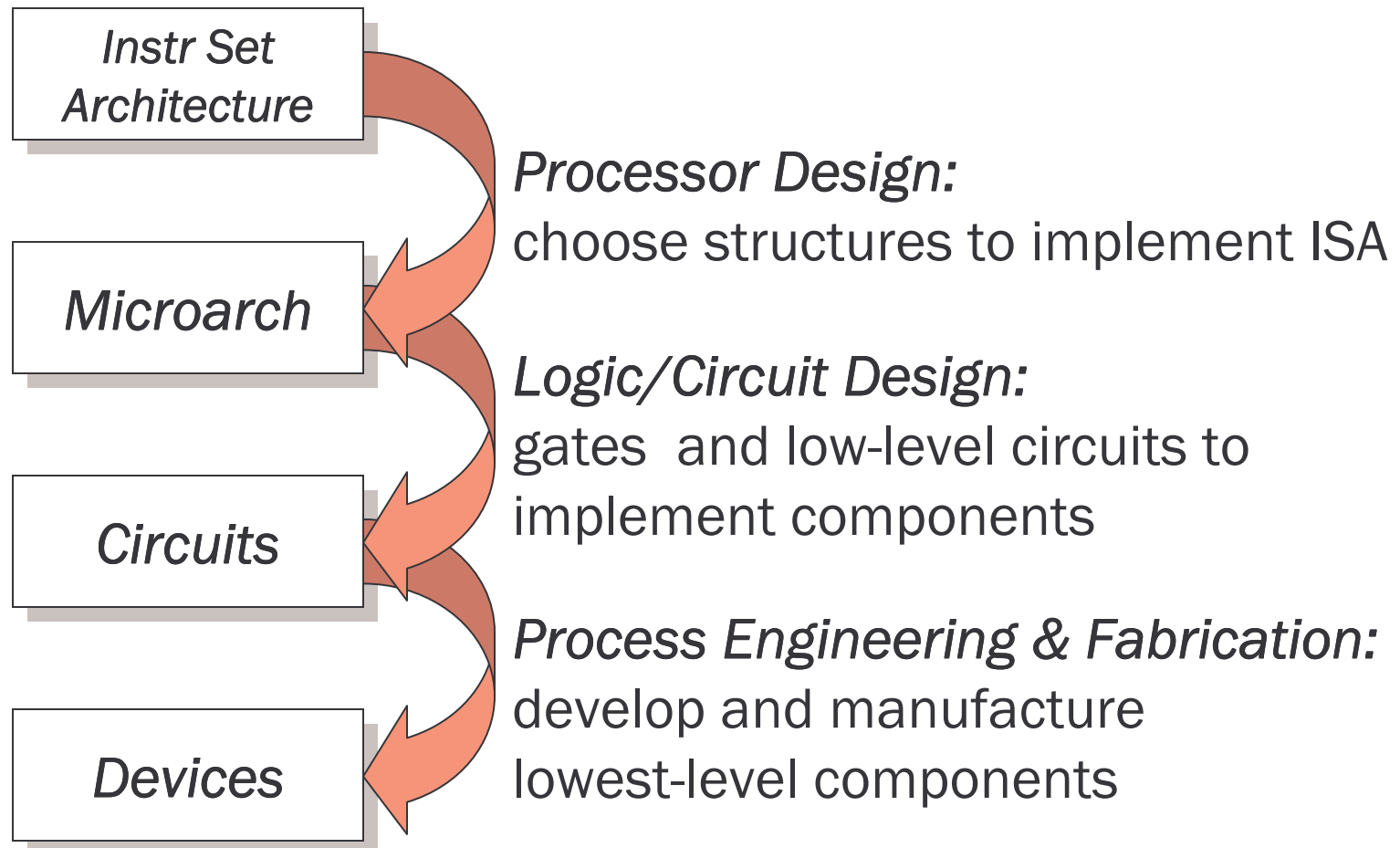
# Big Idea #1: Transformations Between Layers

How do we solve a problem using a computer?

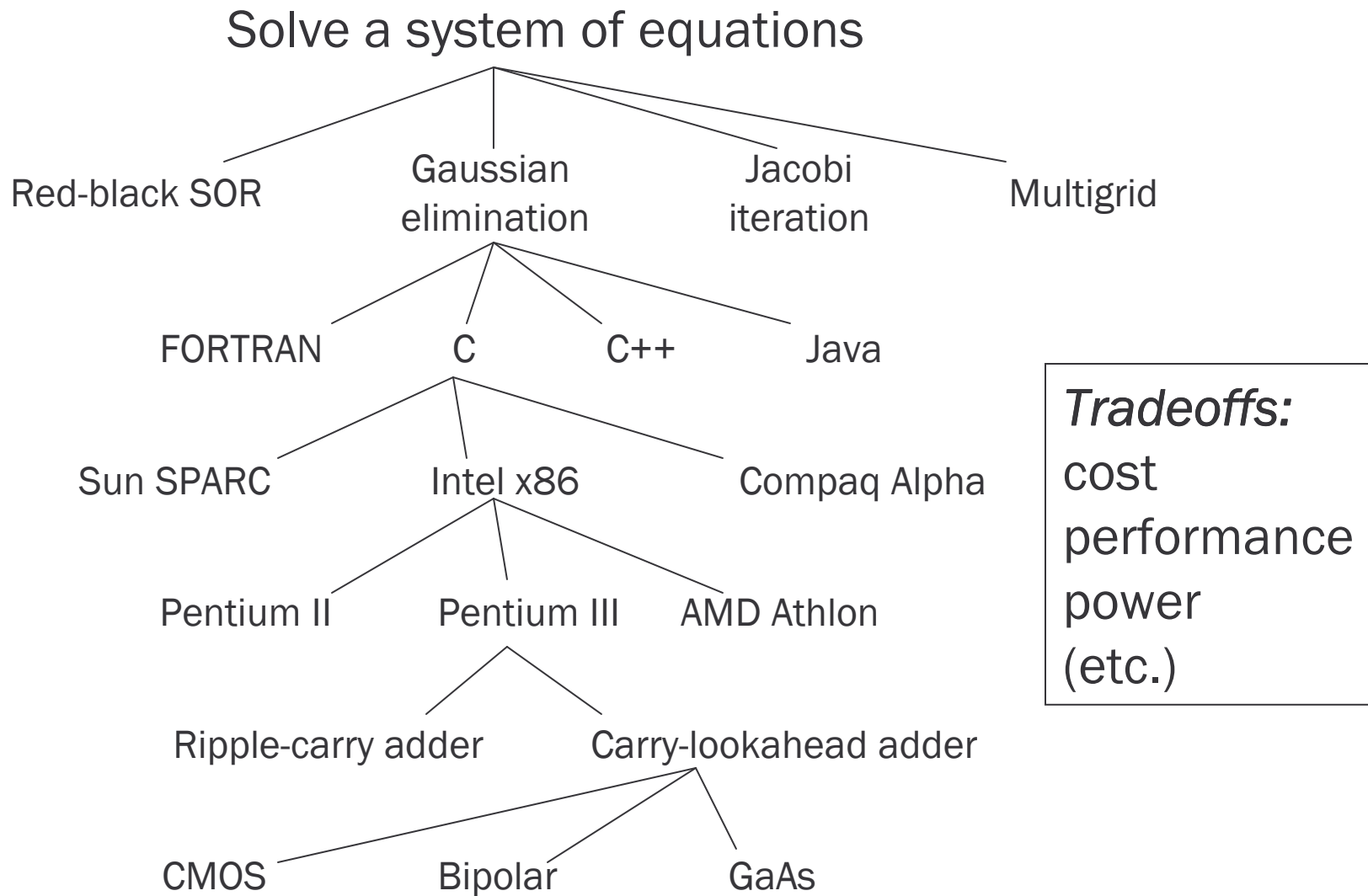
A systematic sequence of transformations between layers of abstraction.



# Deeper and Deeper...



# Many Choices at Each Layer



# How do we represent data in a computer?

---

At the lowest level, a computer is an electronic machine.

- works by controlling the flow of electrons

Easy to recognize two conditions:

1. presence of a voltage – we'll call this state "1"
2. absence of a voltage – we'll call this state "0"

Could base state on *value* of voltage,  
but control and detection circuits more complex.

- compare turning on a light switch to  
measuring or regulating voltage

We'll see examples of these circuits in later chapters.

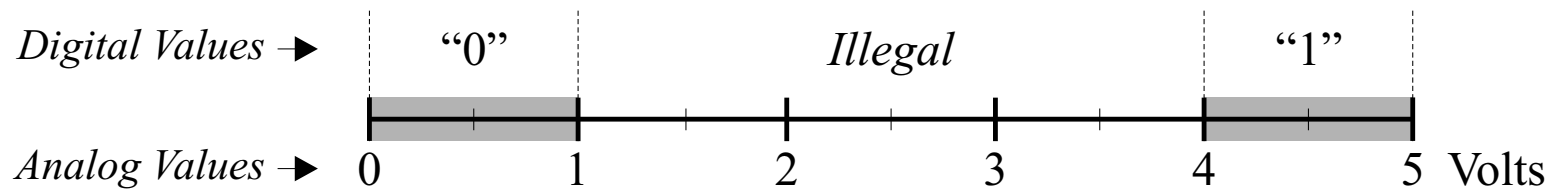
# Computer is a binary digital system.

Digital system:

- finite number of symbols

Binary (base two) system:

- has two states: 0 and 1

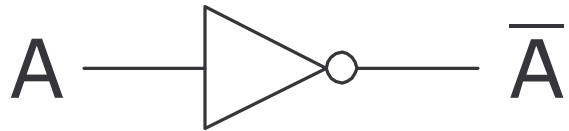


Basic unit of information is the *binary digit*, or **bit**.

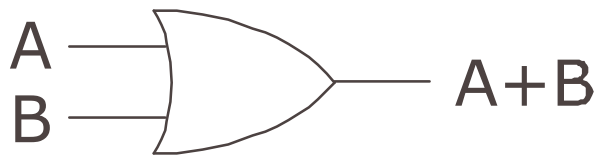
Values with more than two states require multiple bits.

- A collection of two bits has four possible states:  
00, 01, 10, 11
- A collection of three bits has eight possible states:
- A collection of  $n$  bits has  $2^n$  possible states.

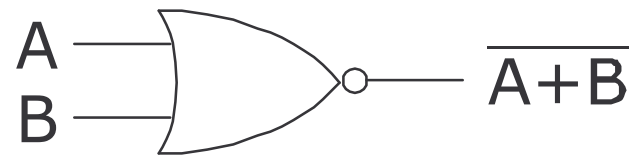
# Basic Logic Gates



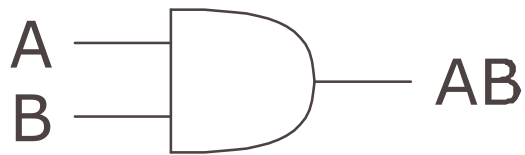
*NOT*



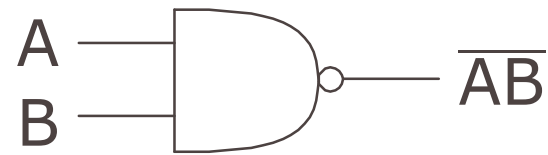
*OR*



*NOR*



*AND*



*NAND*



# Building a Truth Table

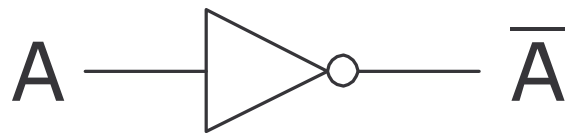
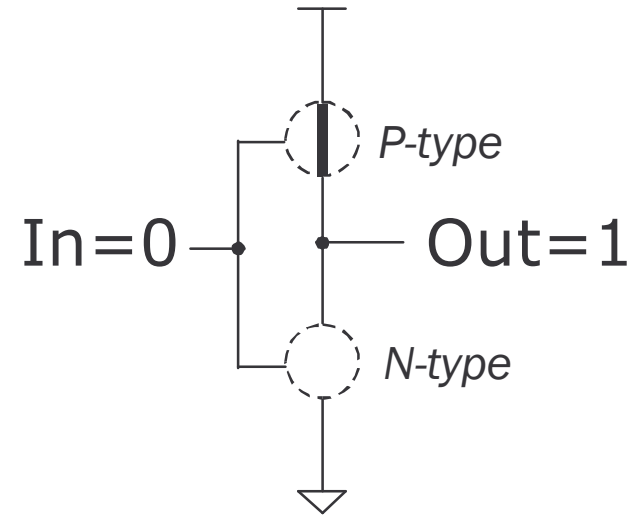
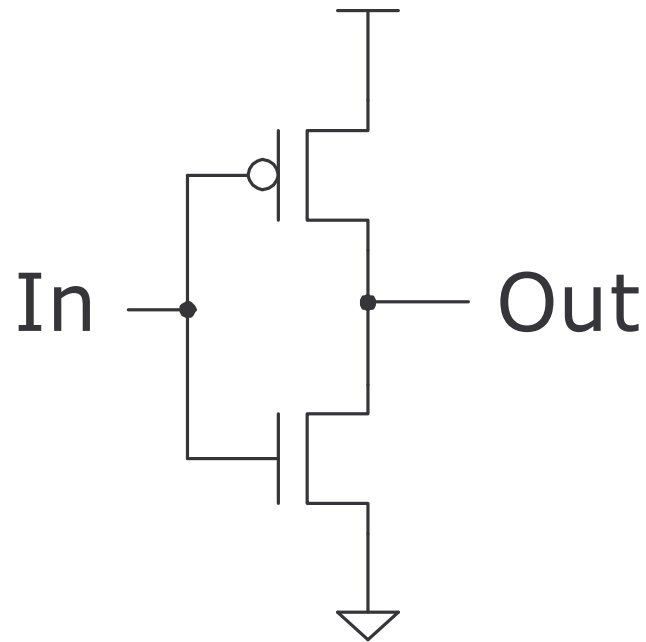
---

**AND**


**OR**


**NOT**


# Inverter (NOT Gate)



In	Out
0V	2.9V
2.9V	0V

In	Out
0	1
1	0

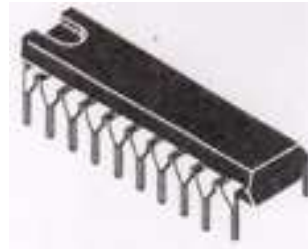
# Electronics Packaging

---

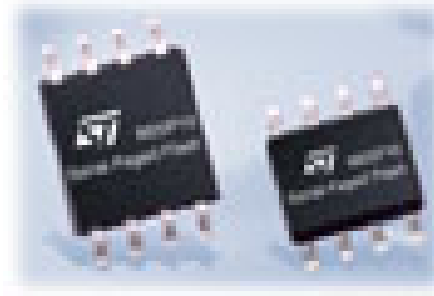
- There are several packaging technologies available that an engineer can use to create electronic devices.
- Some are suitable for inexpensive toys but not miniature consumer products, and some are suitable for miniature consumer products but not inexpensive toys.
- These packages have metal leads that are the conductive wire that connect electricity from the outside world to the silicon inside the package.
- Leads between packages are connected with small copper traces on a printed circuit board (PCB), and the package leads are soldered to the PCB.

# Examples of Electronics Packages

Dual In-line Package (DIP) Older technology, requires the metal leads to go through a hole in the printed circuit board.

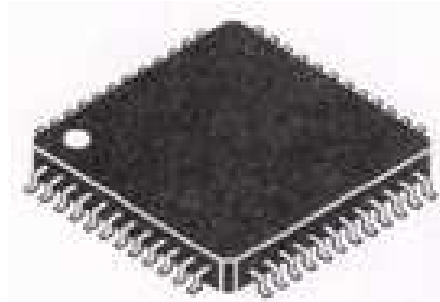


Dual Flat Pack (DFP) - A fairly recent technology, metal leads solder to the surface of the printed circuit board.

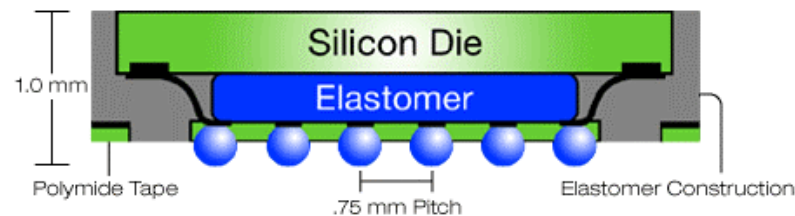


# Examples of Electronics Packages

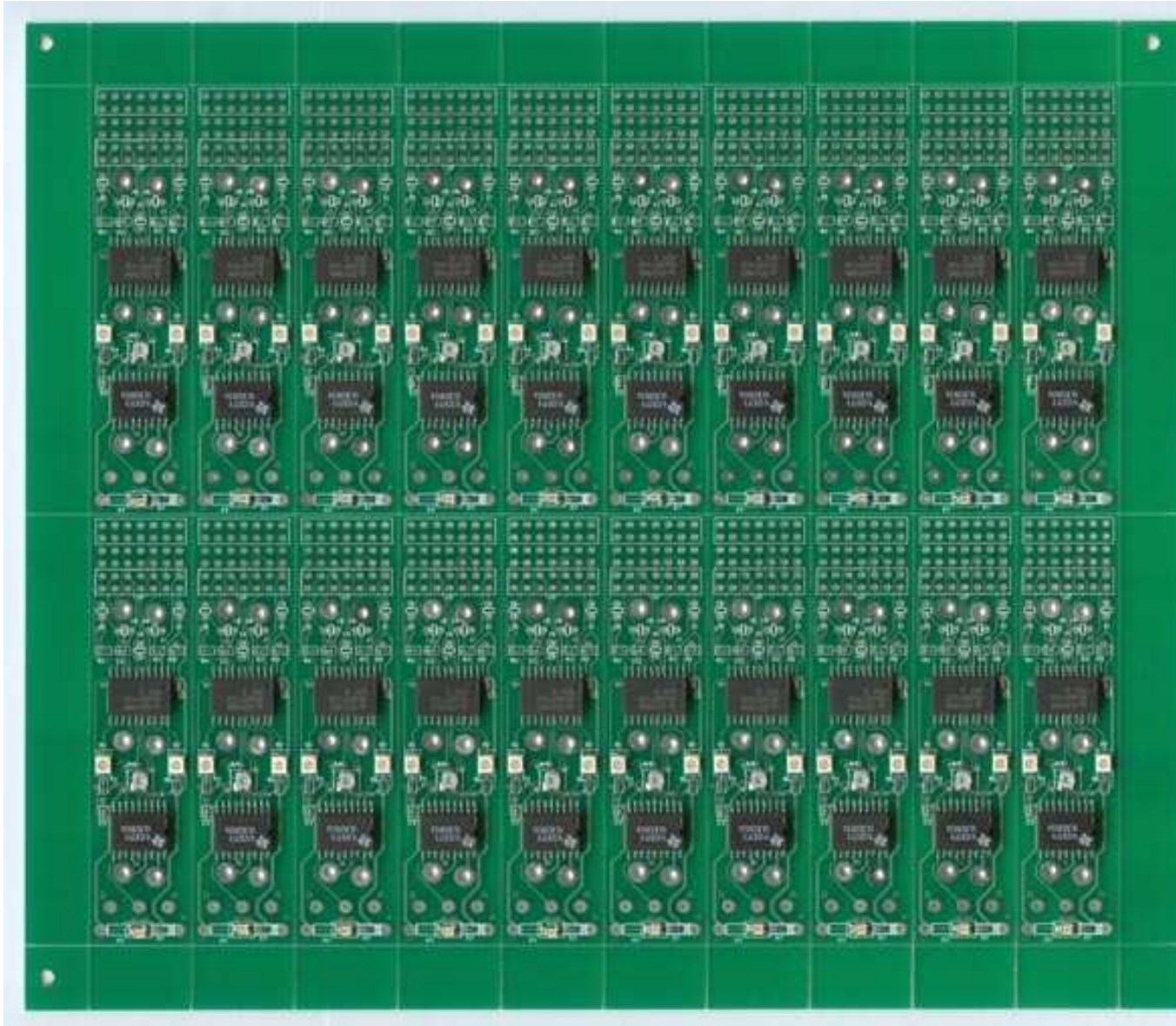
Quad Flat Pack (QFP) - like the Dual Flat Pack, except here are metal leads are on four sides.



Ball Grid Array (BGA) - The connections to the component are on the bottom of the chip, and have balls of solder on these connections.

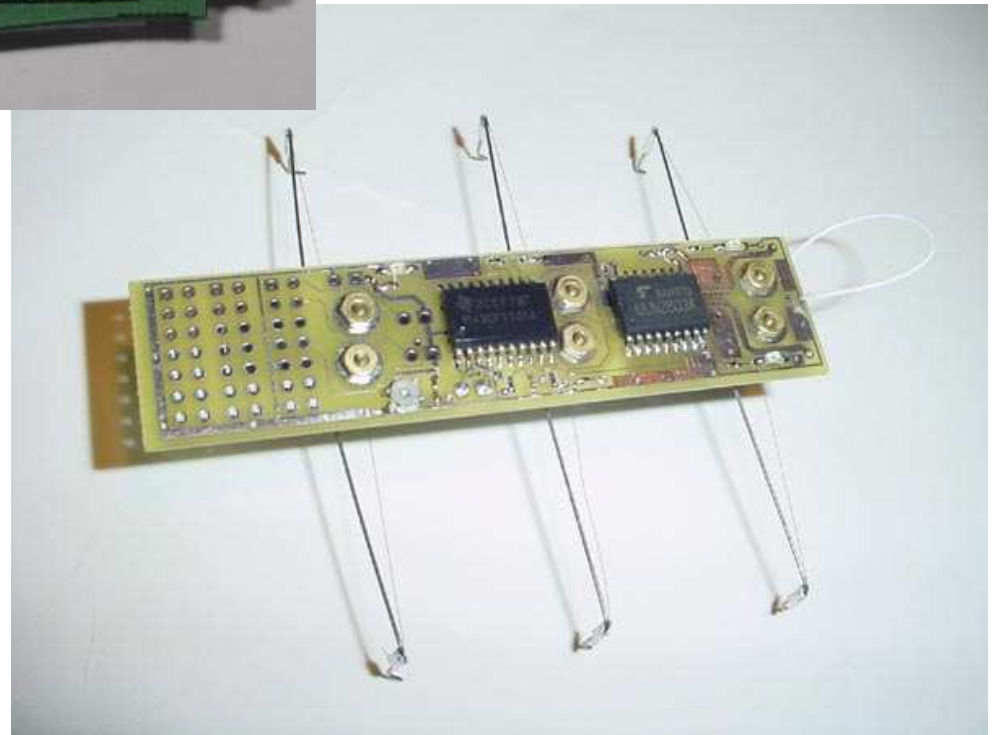
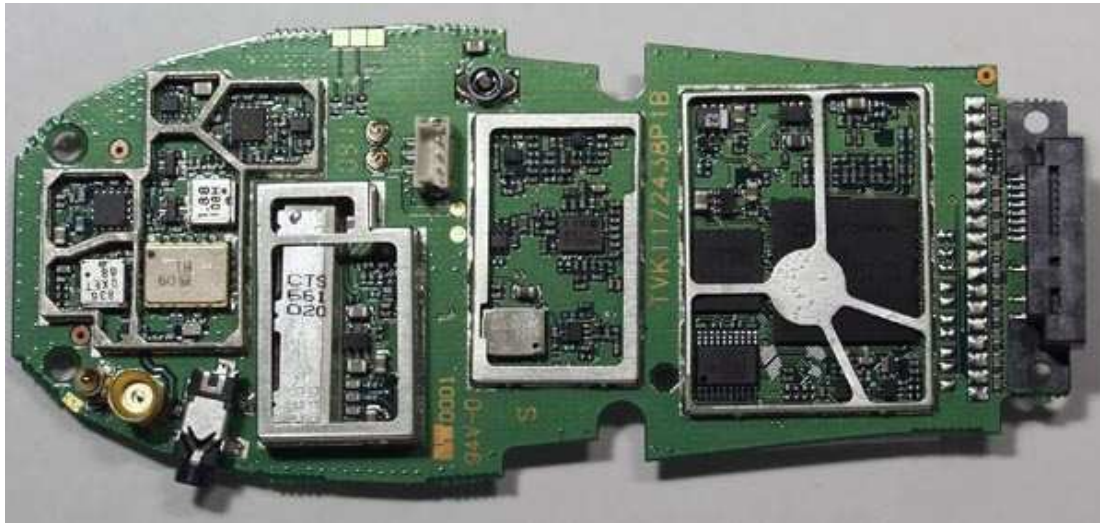


# Using these Components





# The End Products



## Before Next Class . . . .

---

- Visit the class website (will be up by Wednesday noon)
  - Homework 1 will be posted
  - Transparencies will be posted
- Read Chapter 1 and 2