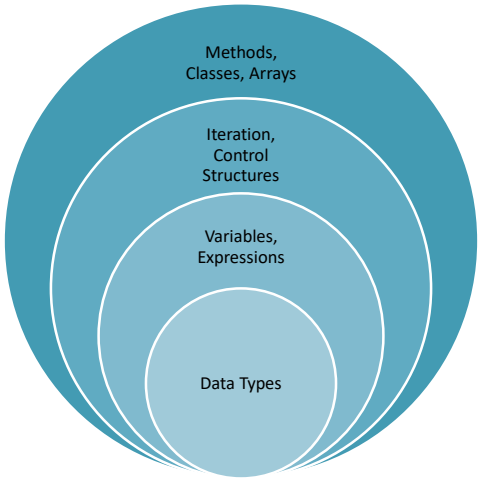
Introduction to Computing and Java

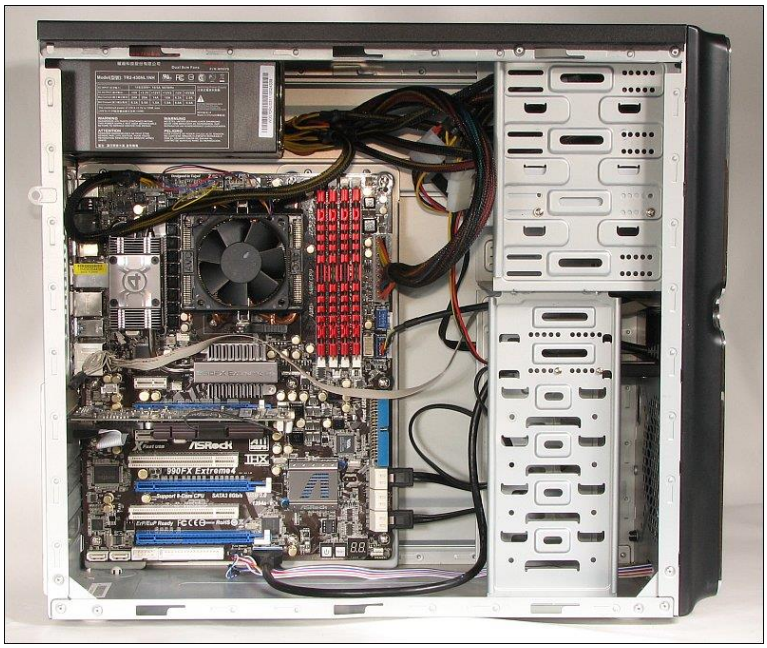
Programming Coverage

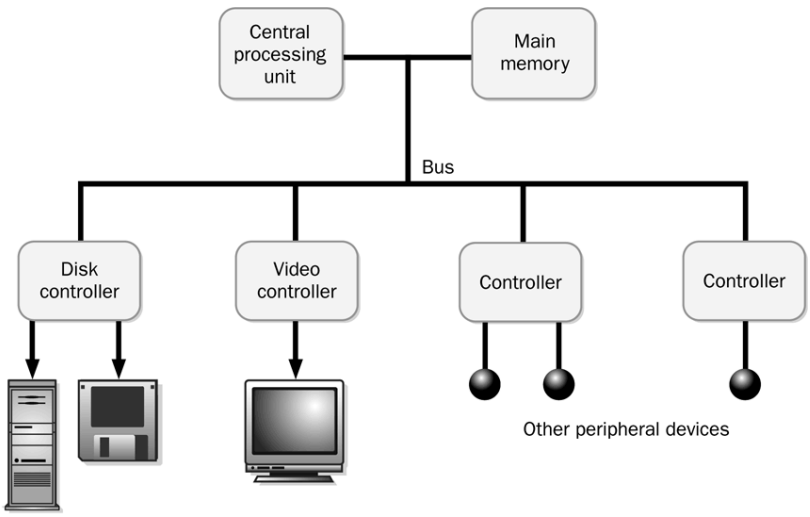


Course Design

- Instead
  - Revel has lots of activities for both learning and to test your understanding
  - Lecture covers most of the same concepts from a different perspective, will include some content only touched upon in Revel

Intro to Computing


ASRock
990FX Extreme4

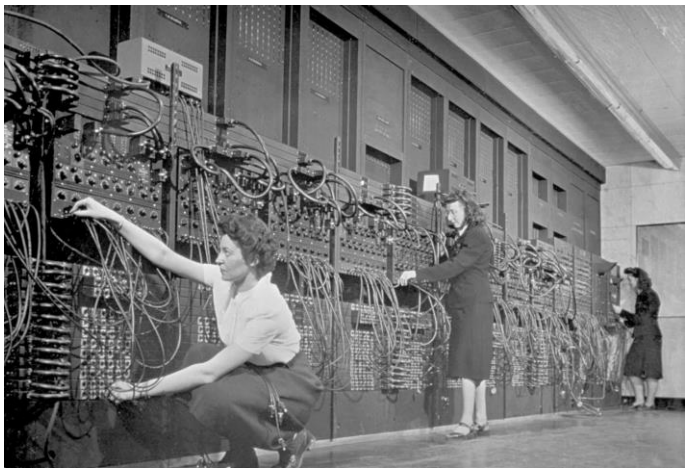

Central processing unit
Main memory
Bus
Disk controller
Video controller
Controller
Controller
Other peripheral devices

The CPU

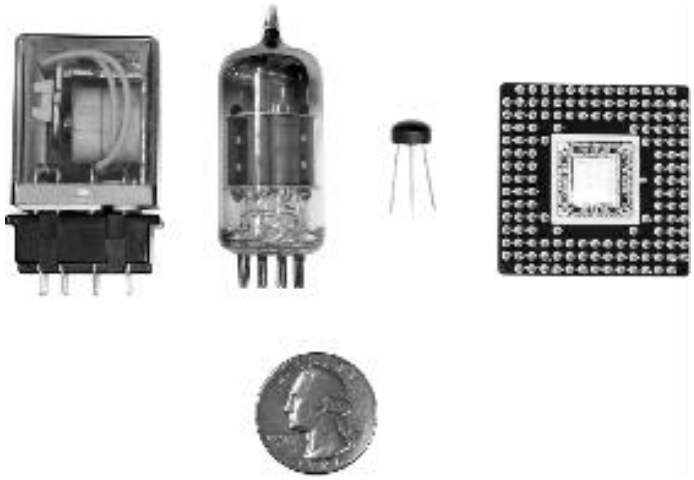
- Fetches instructions from main memory
- Carries out the operations commanded by the instructions
- Each instruction produces some outcome
- A *program* is an entire sequence of instructions
- Instructions are stored as *binary numbers*
- *Binary number* - a sequence of 1's and 0's

Early Computers

- Binary numbers stored as switches



Switches to Transistors



Knowing About: Computer Hardware

- **Bit**: smallest and most basic data item in a computer; represents a 0 or a 1
- **Byte**: a grouping of eight bits
  - E.g., 00010001
- **Word**: a grouping of one or more bytes

1 bit 2 items	2 bits 4 items	3 bits 8 items	4 bits 16 items	5 bits 32 items	
0	00	000	0000	00000	10000
1	01	001	0001	00001	10001
	10	010	0010	00010	10010
	11	011	0011	00011	10011
		100	0100	00100	10100
		101	0101	00101	10101
		110	0110	00110	10110
		111	0111	00111	10111
			1000	01000	11000
			1001	01001	11001
			1010	01010	11010
			1011	01011	11011
			1100	01100	11100
			1101	01101	11101
			1110	01110	11110
			1111	01111	11111

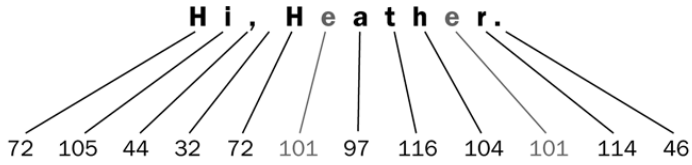
The number of bits used determines the number of items that can be represented

Patterns of bits could represent integer numbers

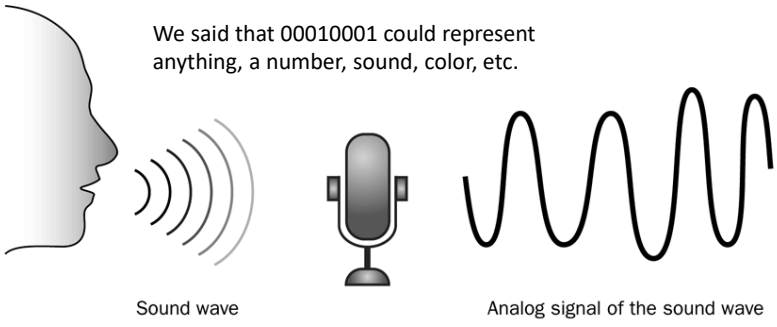
Unit	Symbol	Number of Bytes
byte		$2^0 = 1$
kilobyte	KB	$2^{10} = 1024$
megabyte	MB	$2^{20} = 1,048,576$
gigabyte	GB	$2^{30} = 1,073,741,824$
terabyte	TB	$2^{40} = 1,099,511,627,776$

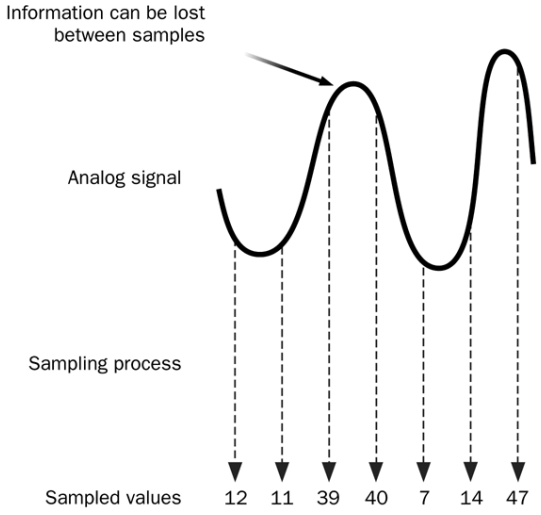
Units of binary storage

Bits could represent characters

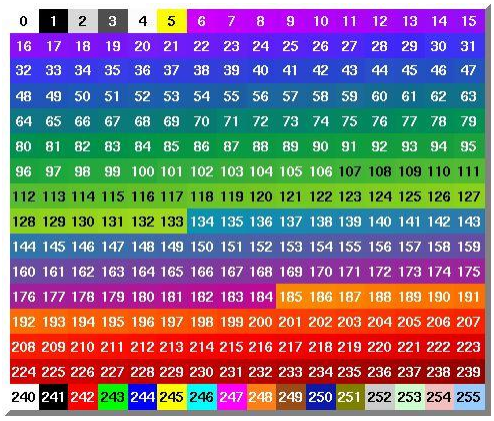


Bits could represent sound





Bits can represent colors

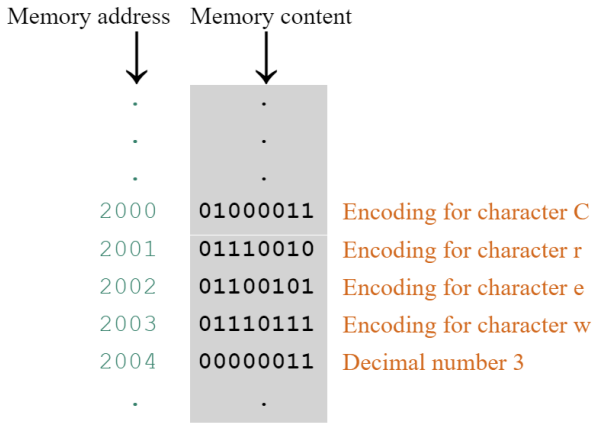


Bits can represent instructions

- 110110
  - might be the instruction to add two numbers
- 110100
  - might be the instruction to increment or add 1 to a number
- Called binary code
- Assembly Code - Mnemonics

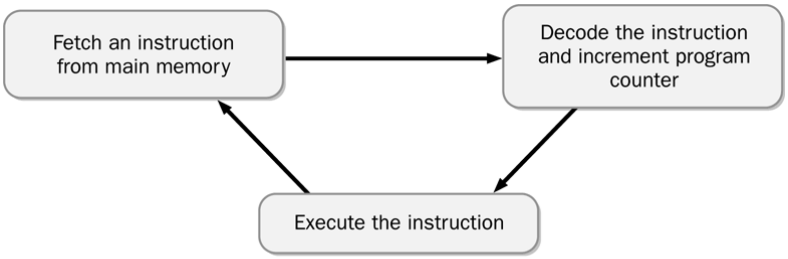
```
Loop:  L.D      F0, 0(R1)
       ADD.D    F4, F0, F2
       S.D      0(R1), F4      ; Drop DADDUI and BNEZ
       L.D      F6, -8(R1)
       ADD.D    F8, F6, F2
       S.D      -8(R1), F8     ; Drop DADDUI and BNEZ
       L.D      F10, -16(R1)
       ADD.D    F12, F10, F2
```

Memory



Memory stores data and program instructions in uniquely addressed memory locations.

The Fetch-Decode Execute Cycle



Layers of Programming Languages

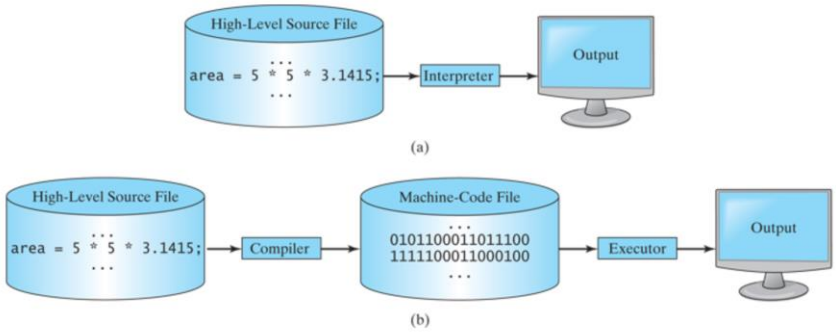
High-Level Language	Assembly Language	Machine Language

a + b	ld [%fp-20], %o0
	ld [%fp-24], %o1
	add %o0, %o1, %o0
		...
		1101 0000 0000 0111
		1011 1111 1110 1000
		1101 0010 0000 0111
		1011 1111 1110 1000
		1001 0000 0000 0000
		...

A high-level expression and its assembly language and machine language equivalent

A program called a **compiler** translates from high-level to machine language

Interpreters and Compilers



Java is both compiled and interpreted! Will explain more later.

Java Example

- In-class: Entering and running a “Hello, World” program using DrJava

File: HelloWorld.java

```
/*
 *  Normally you would put your name and assignment info here
 *  This program prints out "Hello, World".
 */
public class HelloWorld
{
   public static void main(String[] args)
   {
      System.out.println("Hello, world!");
   }
}
```

Behind the Scenes