Inside the Computer

Chapter 3
And, make good decisions when purchasing a PC.
Electronic Signals

Analog

Digital
Only 2 states possible

<table>
<thead>
<tr>
<th>On</th>
<th>Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Electronic pulse present | Electronic pulse absent \} Human readable symbols

Positive magnetic field | Negative magnetic field \} Inside the computer’s memory

Pitted | Not Pitted \} Permanently stored on floppy disk

Permanently stored on CD-ROM
Digitizing Data

“A” is represented by this bit pattern
1 byte = 8 bits

0 1 0 0 0 0 0 0 1

Off Off Off Off Off Off Off On
Please memorize by our next class.

Just kidding!

### ASCII Chart

<table>
<thead>
<tr>
<th>Character</th>
<th>ASCII Code</th>
<th>Character</th>
<th>ASCII Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100 0001</td>
<td>0</td>
<td>011 0000</td>
</tr>
<tr>
<td>B</td>
<td>100 0010</td>
<td>1</td>
<td>011 0001</td>
</tr>
<tr>
<td>C</td>
<td>100 0011</td>
<td>2</td>
<td>011 0010</td>
</tr>
<tr>
<td>D</td>
<td>100 0100</td>
<td>3</td>
<td>011 0011</td>
</tr>
<tr>
<td>E</td>
<td>100 0101</td>
<td>4</td>
<td>011 0100</td>
</tr>
<tr>
<td>F</td>
<td>100 0110</td>
<td>5</td>
<td>011 0101</td>
</tr>
<tr>
<td>G</td>
<td>100 0111</td>
<td>6</td>
<td>011 0110</td>
</tr>
<tr>
<td>H</td>
<td>100 1000</td>
<td>7</td>
<td>011 0111</td>
</tr>
<tr>
<td>I</td>
<td>100 1001</td>
<td>8</td>
<td>011 1000</td>
</tr>
<tr>
<td>J</td>
<td>100 1010</td>
<td>9</td>
<td>011 1001</td>
</tr>
<tr>
<td>K</td>
<td>100 1011</td>
<td>Space</td>
<td>010 0000</td>
</tr>
<tr>
<td>L</td>
<td>100 1100</td>
<td>.</td>
<td>010 1110</td>
</tr>
<tr>
<td>M</td>
<td>100 1101</td>
<td>(</td>
<td>010 1000</td>
</tr>
<tr>
<td>N</td>
<td>100 1110</td>
<td>+</td>
<td>010 1011</td>
</tr>
<tr>
<td>O</td>
<td>100 1111</td>
<td>&amp;</td>
<td>010 0110</td>
</tr>
<tr>
<td>P</td>
<td>101 0000</td>
<td>$</td>
<td>010 0100</td>
</tr>
<tr>
<td>Q</td>
<td>101 0001</td>
<td>*</td>
<td>010 1010</td>
</tr>
<tr>
<td>R</td>
<td>101 0010</td>
<td>)</td>
<td>010 1001</td>
</tr>
<tr>
<td>S</td>
<td>101 0011</td>
<td>;</td>
<td>011 1011</td>
</tr>
<tr>
<td>T</td>
<td>101 0100</td>
<td>,</td>
<td>010 1100</td>
</tr>
<tr>
<td>U</td>
<td>101 0101</td>
<td>-</td>
<td>101 1111</td>
</tr>
<tr>
<td>V</td>
<td>101 0110</td>
<td>?</td>
<td>011 1111</td>
</tr>
<tr>
<td>W</td>
<td>101 0111</td>
<td>:</td>
<td>011 1010</td>
</tr>
<tr>
<td>X</td>
<td>101 1000</td>
<td>=</td>
<td>011 1101</td>
</tr>
<tr>
<td>Y</td>
<td>101 1001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
- Electronic circuit board
- Chipset
- Provides path among
  - CPU
  - RAM
  - Peripherals
Exploring the Motherboard

- Microprocessor
- Memory Chips
- Electronic Bus
- Device Controllers
- Expansion Slots/Cards
Intel Processor Progression

- 286, 386, 486
- Pentium®
- Pentium® Pro
- Pentium® II
- Pentium® III
- Celeron®
- Itanium™

Photo Courtesy of Intel Corporation
Microprocessor: Computer on a Chip

- **Primary Functions**
  - Read/Interpret program instructions
  - Direct the operation of internal components
  - Control flow of programs/data to RAM

- **CPU includes:**
  - Control unit
  - ALU

Photo Courtesy of Intel Corporation
Control Unit & ALU

- **Control Unit**
  - Decoder
  - Registers
  - Instruction register
  - Program register
- **Arithmetic Logic Unit**
  - Accumulator
Everything clear so far?????
Memory Types

- RAM
- ROM
- PROM
- Flash
- Cache
Memory: RAM

- Random Access Memory
- Direct link to CPU
- Holds current data and programs at a RAM address
- Temporary/Volatile
- Common RAM capacities: 128 MB, 256 MB, 384 MB and 512 MB
Memory: Types of RAM

- **SDRAM (Synchronous Dynamic RAM)**
  - Can synchronize itself with the processor

- **RDRAM (Rambus DRAM)**
  - Newer and more expensive
  - 6 times faster than SDRAM

- **Installation**
  - SIMMs: 32-bit data path to CPU (single)
  - DIMMs: 64-bit data path to CPU (dual)
  - RIMMs: faster RDRAM chips (use to upgrade)
Memory: Cache

- Faster and more costly than RAM
- Much smaller capacity than RAM
- Holds next instructions
- Increases system *throughput*
Memory: ROM

- Read Only Memory
- Permanent, cannot change
- Loads Operating System during boot process
- PROM
Memory: Flash

- Type of PROM
- Can be changed by user
- Non-volatile
- Upgrade by downloading software from the Web or disk
- No longer need to replace chips or circuit boards
Storage Capacity

- **Byte** - one character
- **Kilobyte (KB)** - 1024 bytes
- **Megabyte (MB)** - about 1 million bytes
- **Gigabyte (GB)** - about 1 billion bytes
- **Terabyte (TB)** - about 1 trillion bytes
What Happens Inside

Input Unit

Control Unit

Arithmetic Logic Unit

Main memory

Output Unit

Control flow

Instruction flow

Data flow
Machine Cycle: Making the Rounds

- Everything is translated to Machine Language
- Machine Cycle = Instruction Time + Execution Time

Diagram:
- Fetch Instruction
- Decode Instruction
- Execute Instruction
- Place result in memory

Instruction Time
Execution Time
Ports

- **Parallel**
  - 8 bits at a time
  - Fast
  - Printers
  - Short distances

- **Serial**
  - 1 bit at a time
  - Slow
  - Mice and modems
  - Long distances

- **IrDA**
  - Infrared Light waves
  - Printers
  - Short distance

- **SCSI**
  - 15 peripherals
  - Daisychained

- **USB**
  - 127 peripherals
  - Daisychained
Expansion boards are made to fit a particular type of bus

Bus Types:
- ISA bus
- PCI local bus
- SCSI bus
- USB bus (hot plug)
Adding Peripherals

Expansion Slot

Peripheral plugs into port

Pins plug into slot

Expansion Card

Courtesy of ATI Technologies Inc.
Adding Peripherals

- AGP graphics adapter
- Sound
- Data/Voice/Fax modem
- Cable modem
- Extra serial and parallel ports
- NIC card
- Video capture card
PCMCIA Card

U.S. Robotics Mobile Communications Corporation
Describing the Processor

- **Word Size**
  - 64-bit for PCs
- **Processor Speed**
  - MHz, MIPS, FLOPS
  - 400 MHz to 1 plus GHz for PCs
- **RAM Capacity**
  - 128 to 512 MB for PCs
- **Processor Personality**
Processor Design

- CISC
- RISC
- Parallel Processing
- Neural Networks
End of Chapter 3