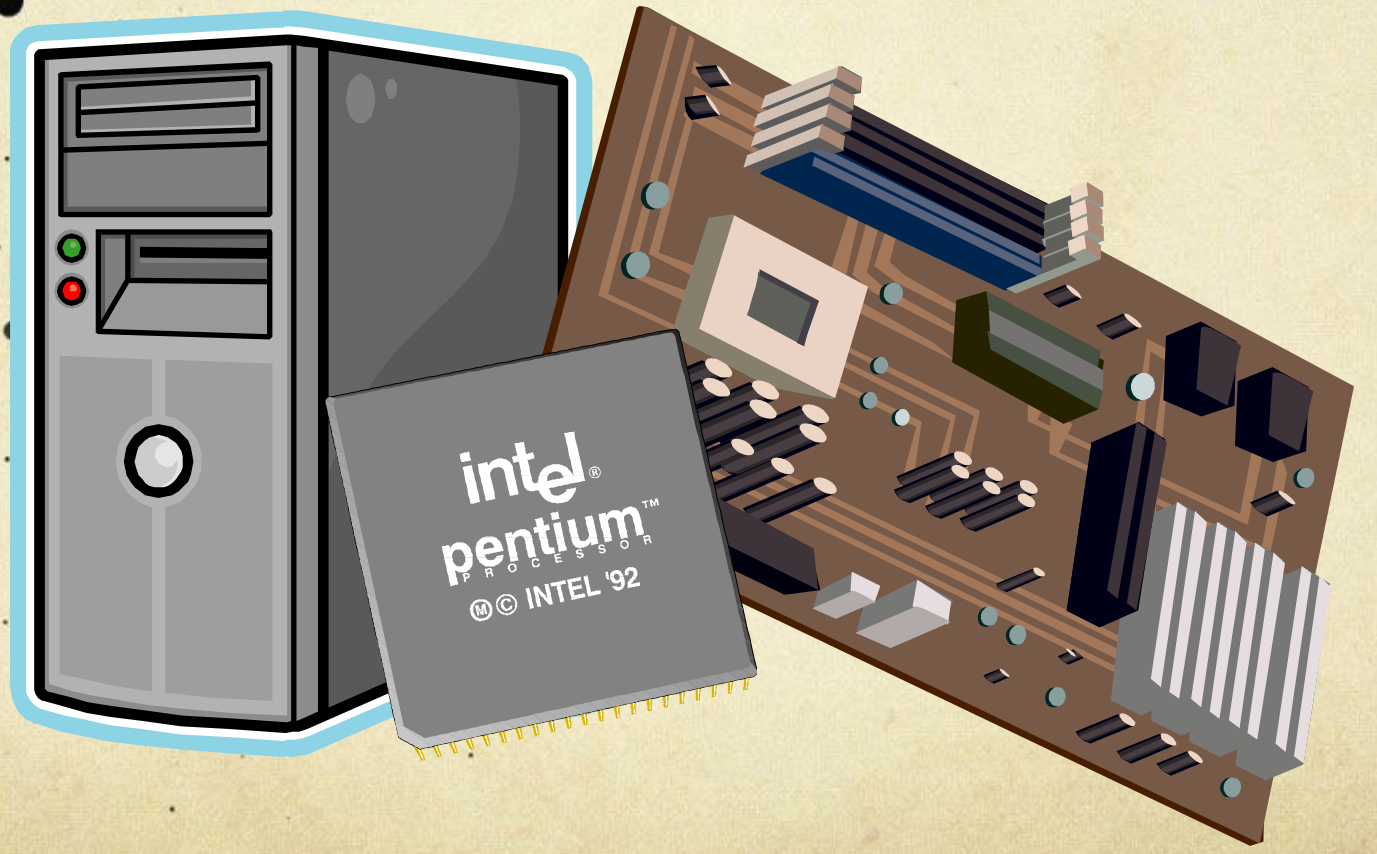
Today's lecture is all about the System Unit, the Motherboard , and the Central Processing Unit, Oh My!



Or “what’s happening inside the computer?”

Digital Data Representation

- Computers may seem smart, but they can only understand two states.
  - On/Off
  - Positive/Negative
  - Current/No Current
  - Yes/ No

The digits 1 and 0 represent these binary states.

Binary Numbers

01100111011101110110011101101110011010111011101110100110101
0101110110111011011101101110010101101010101010101010101

0 and 1 are binary digits called bits

eight bit binary numbers are bytes

half of a byte (4 bits) is a nibble

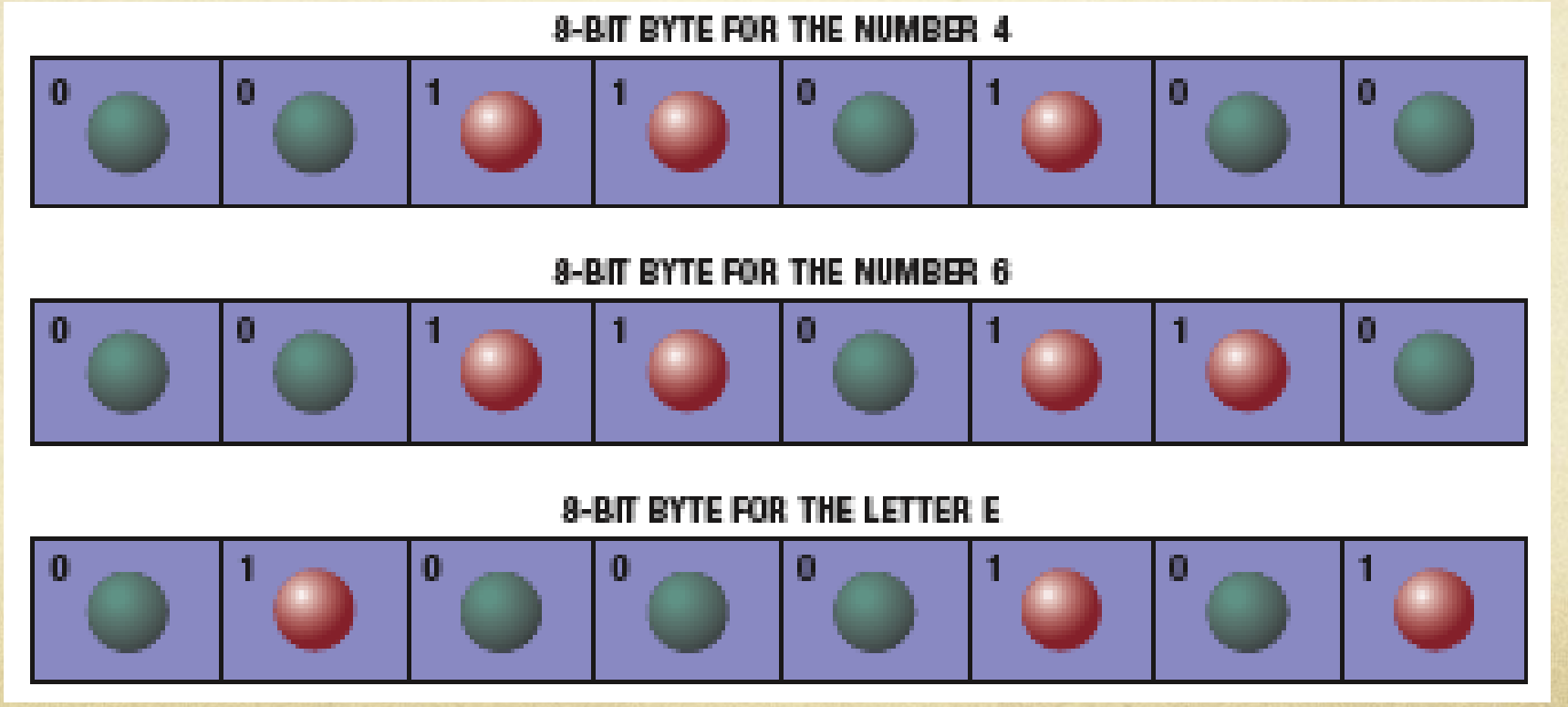
One byte represents 256 separate symbols or characters

Characters and symbols are defined using a coding scheme like ASCII

0011 0100 = 4

0011 0110 = 6

0100 0101 = E



Coding Schemes

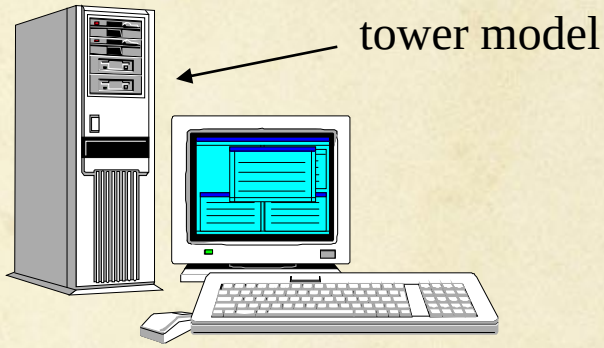
ASCII	SYMBOL	EBCDIC
00110000	0	11110000
00110001	1	11110001
00110010	2	11110010
00110011	3	11110011
00110100	4	11110100
00110101	5	11110101
00110110	6	11110110
00110111	7	11110111
00111000	8	11111000
00111001	9	11111001
01000001	A	11000001
01000010	B	11000010
01000011	C	11000011
01000100	D	11000100
01000101	E	11000101
01000110	F	11000110
01000111	G	11000111
01001000	H	11001000
01001001	I	11001001
01001010	J	11010001
01001011	K	11010010
01001100	L	11010011
01001101	M	11010100

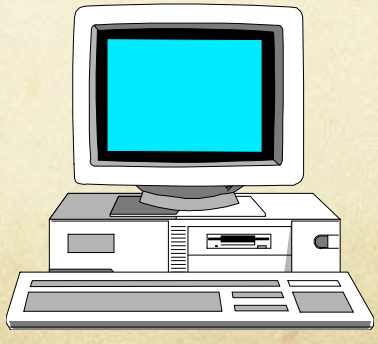
ASCII	SYMBOL	EBCDIC
01001110	N	11010101
01001111	O	11010110
01010000	P	11010111
01010001	Q	11011000
01010010	R	11011001
01010011	S	11100010
01010100	T	11100011
01010101	U	11100100
01010110	V	11100101
01010111	W	11100110
01011000	X	11100111
01011001	Y	11101000
01011010	Z	11101001
00100001	!	01011010
00100010	"	01111111
00100011	#	01111011
00100100	$	01011011
00100101	%	01101100
00100110	&	01010000
00101000	(	01001101
00101001	)	01011101
00101010	*	01011100
00101011	+	01001110

System Unit (or chassis)

The box-like case that houses the electronic components of the computer.

- motherboard
- expansion cards
- hard drive
- floppy and CD drives
- bays
- power supply



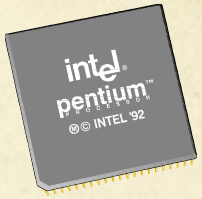


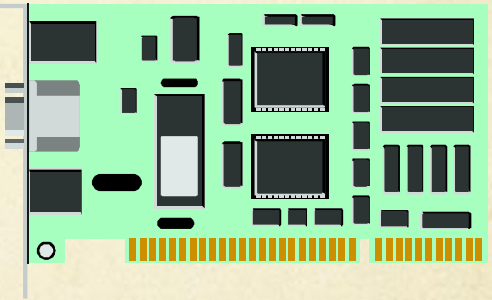
Motherboard

The main circuit board in the computer

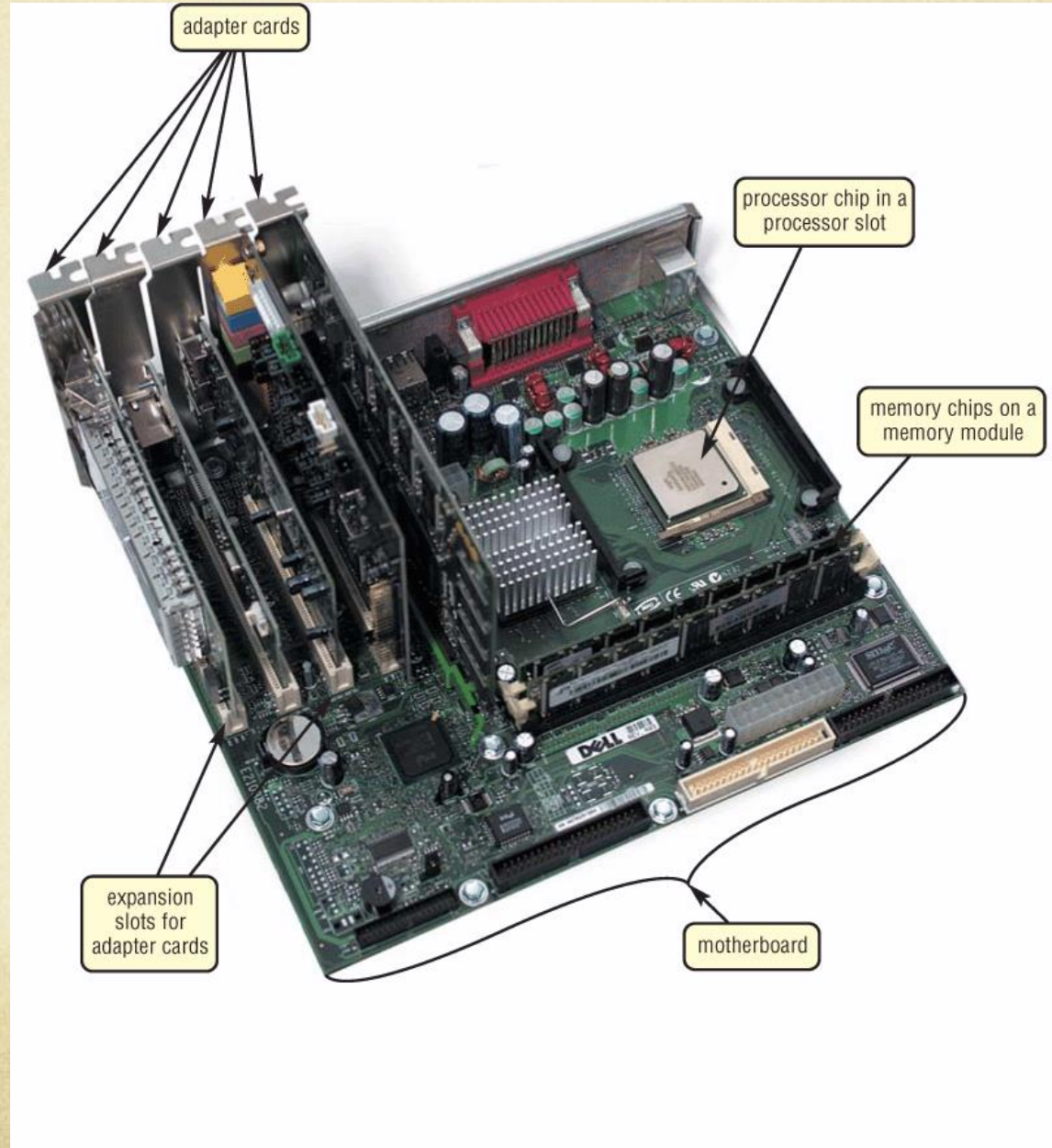
contains:

- CPU or Microprocessor chip
- System clock
- Battery
- Heat Sink/Fan
- Ports
- Expansion slots
- Buses – allow communication between components
- Memory - RAM and ROM



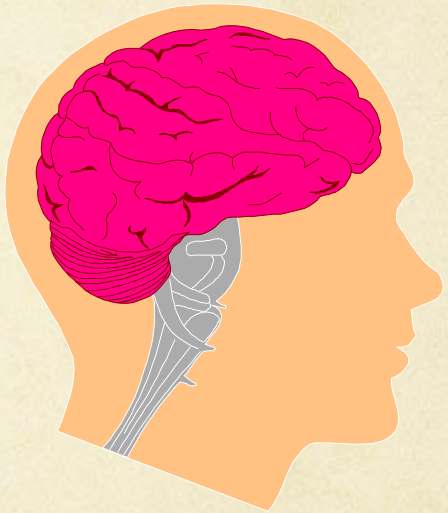


Motherboard



Central Processing Unit

The **C**entral **P**rocessing **U**nit, also called the microprocessor or chip, is the brain of the computer. It interprets and carries out the instructions that operate a computer.



The CPU has two basic parts:

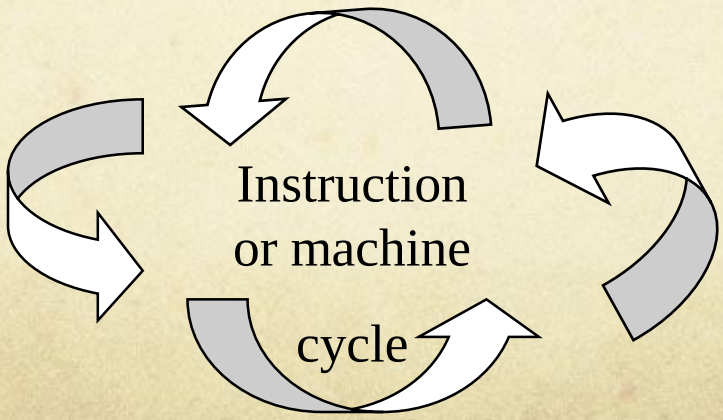
- The **Control Unit** coordinates and controls all parts of the computer.
- The **A**rithmetic **L**ogic **U**nit (ALU) performs the arithmetic, logical, and comparative operations.

  (The **F**loating **P**oint **U**nit (FPU) performs arithmetic operations requiring decimals.)

01100111011101110110011101101110011010111011101110111001101111
10010101010110110101101011110101110110111011011101011101

Control Unit

1. gets instruction/data from memory (called fetching)
2. translates the instruction for ALU/FPU (decoding)
3. performs the command (executing)
4. writes result to memory (storing)



Arithmetic Logic Unit

- Arithmetic (+, - , x, /)
- Comparative (<, = , >)
- Logical (AND, OR, NOT)

Registers – are special high-speed storage locations **in the processor** that temporarily hold data and instructions during the machine cycle.

Generally, more registers and bigger registers translates to increased CPU performance.

- store location of instruction
- store instruction while decoding
- store data while its being processed
- store results of calculation

System Clock

- generates regular pulses or ticks
- each tick is a clock cycle
- clock speed (or rate) is the speed at which a processor executes instructions

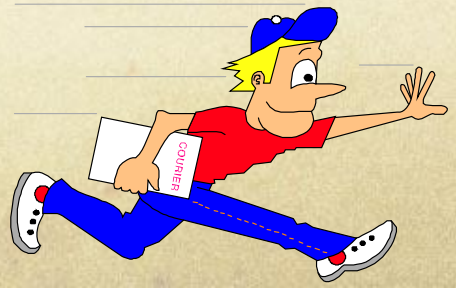
- Clock speeds are measured in gigahertz (billion ticks per second)

Speeding things up

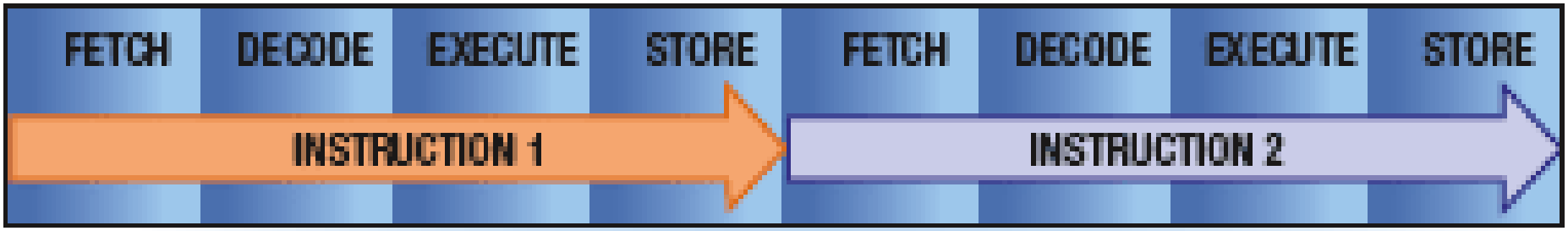
- **Pipelining –** CPU begins executing a second instruction before the previous instruction has completed its machine cycle.

- **Coprocessors –** additional processor chip that assists the processor in performing specific tasks.

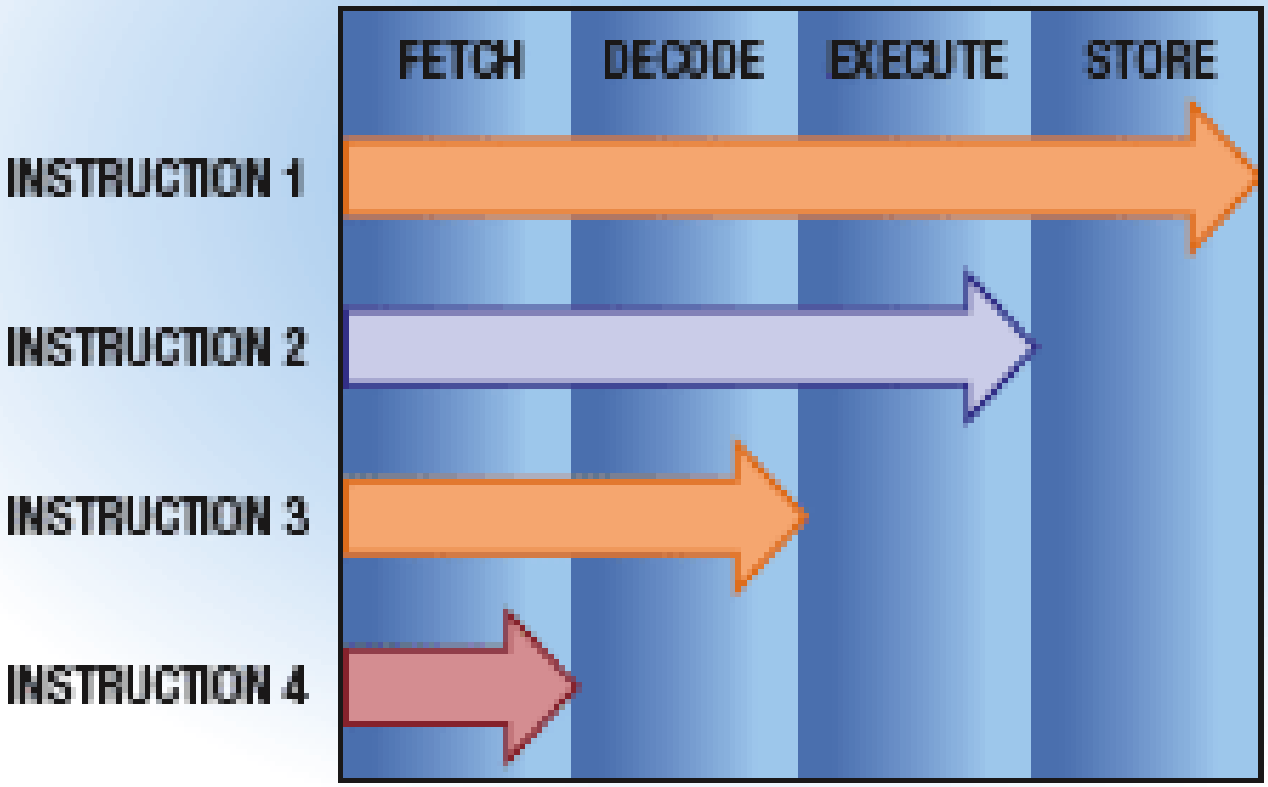
- **Parallel Processors –** Using more than one processor to divide up the work.



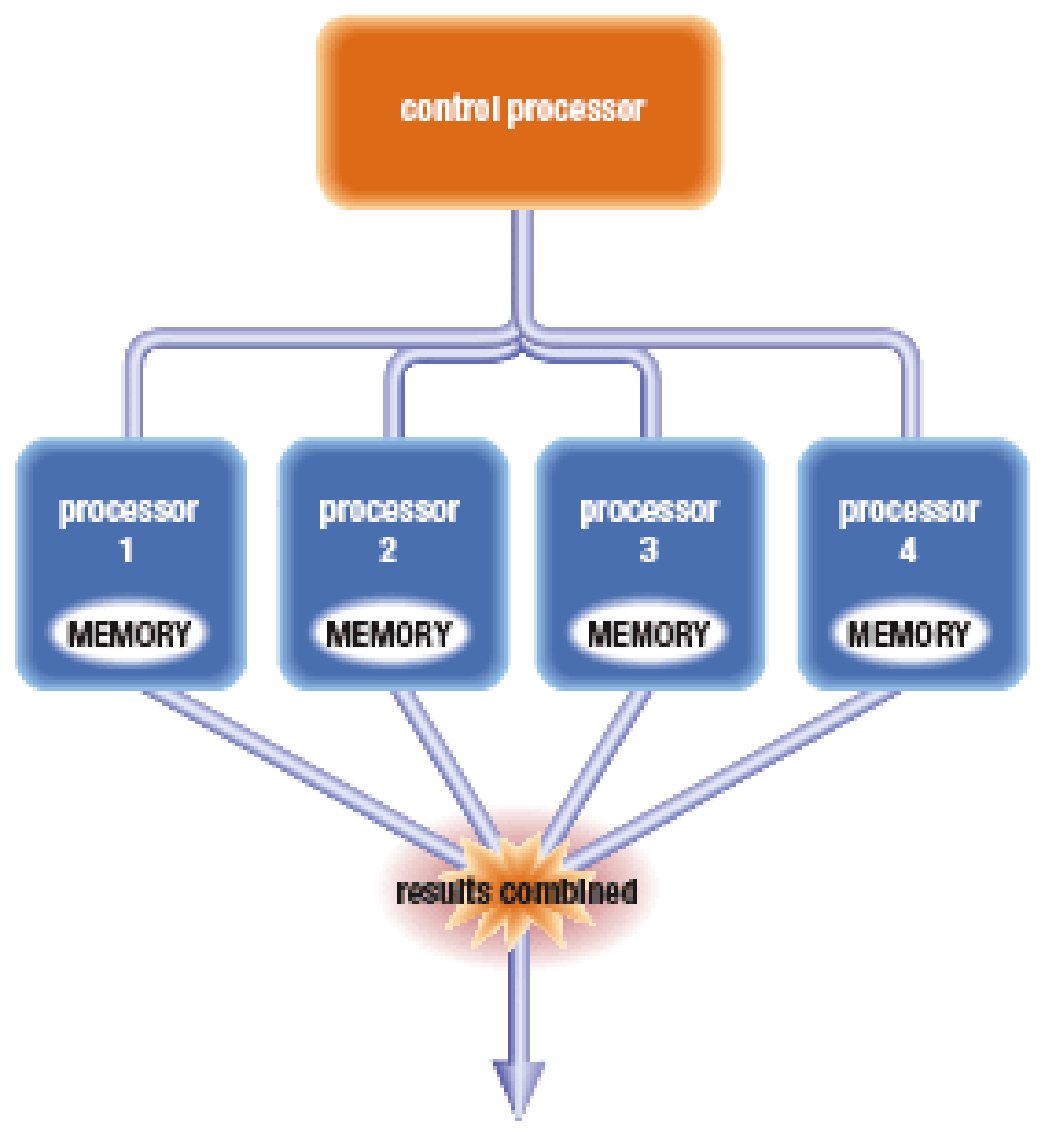
MACHINE CYCLE (without pipelining):



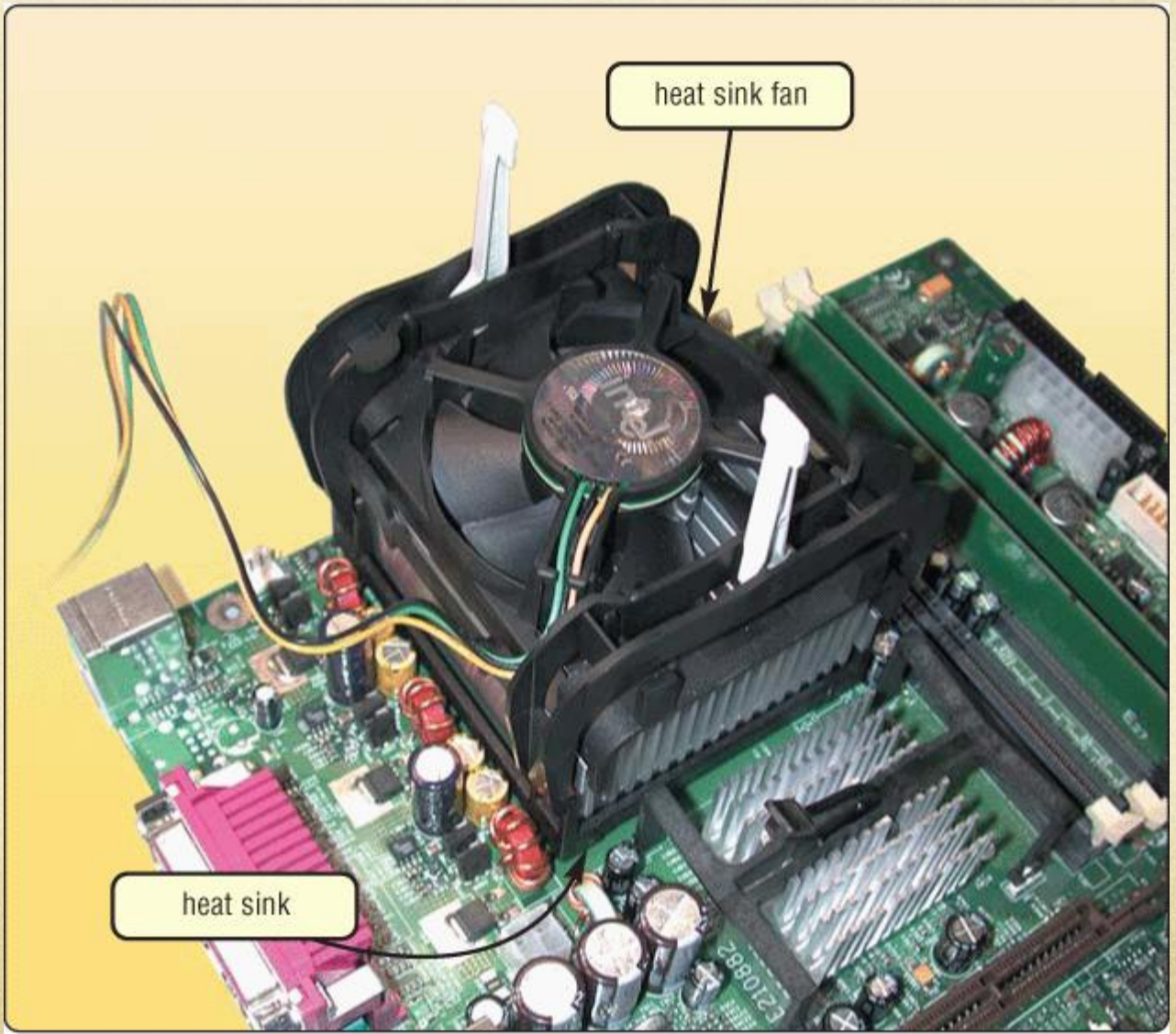
MACHINE CYCLE (with pipelining):



Parallel Processing



Heat Sinks



Be sure you can:

- Define the terms bit and byte
- Explain why computers use binary numbers
- Understand how the binary number system works
- Explain why programmers use octal or hexadecimal number systems
- List the prefixes (and their numeric equivalents) used to define large groups of bytes
- Define the two parts of the Central Processing unit
- Explain what the ALU does
- Explain what the control unit does
- List the four steps in the machine (or instruction) cycle
- Describe the 3 types of operations performed by the ALU
- Explain what a register is
- Explain how the system clock affects processing speed
- Define pipelining, parallel processing and co-processors
- Explain the purpose of a heat sink

Homework/Labs

- Read pages 36 – 38 on Memory
- Do the Binary/Hex/Decimal conversion Worksheet (You probably want to create a “cheat” sheet first)