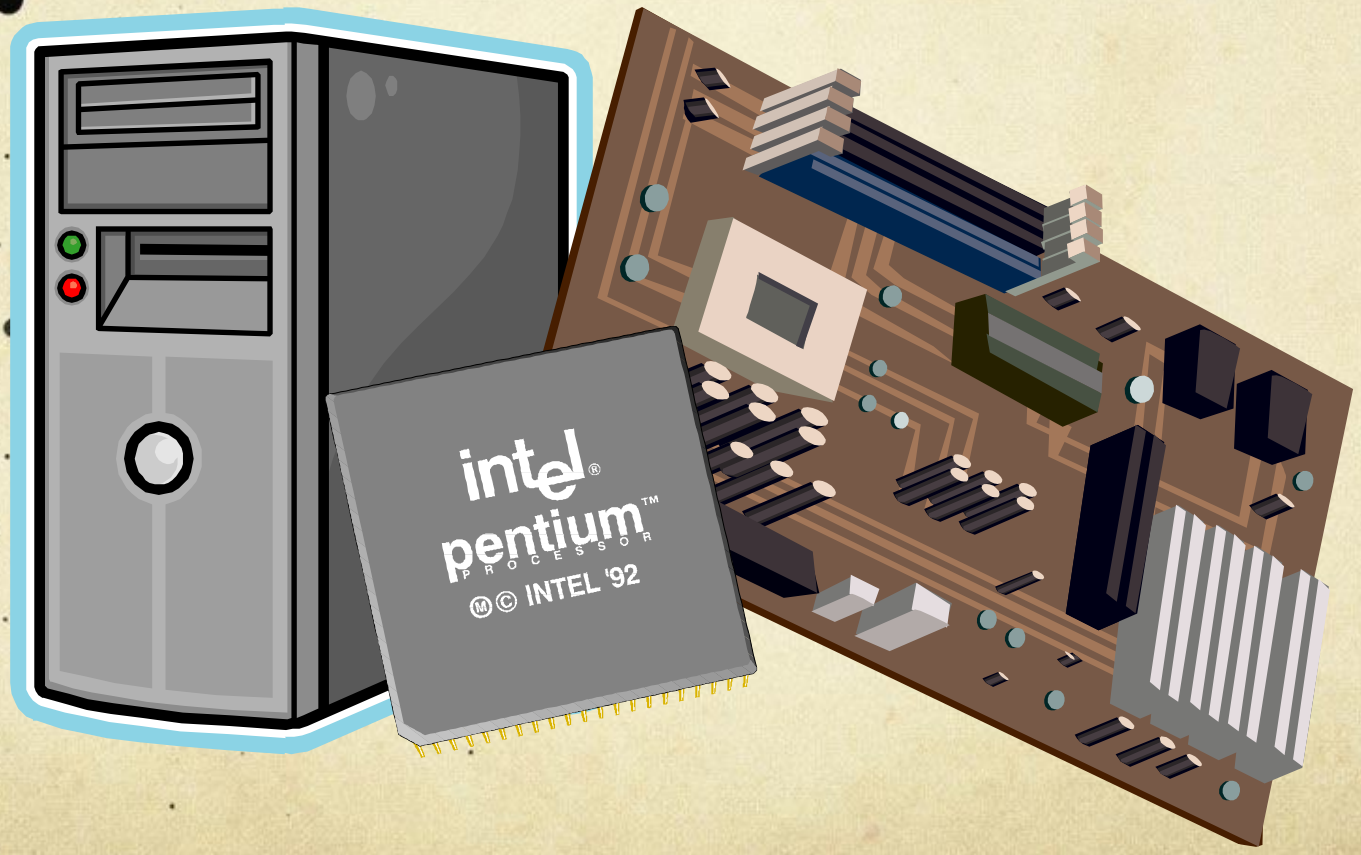
Today's lecture is all about the System Unit, the Motherboard , and the Central Processing Unit, Oh My!



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

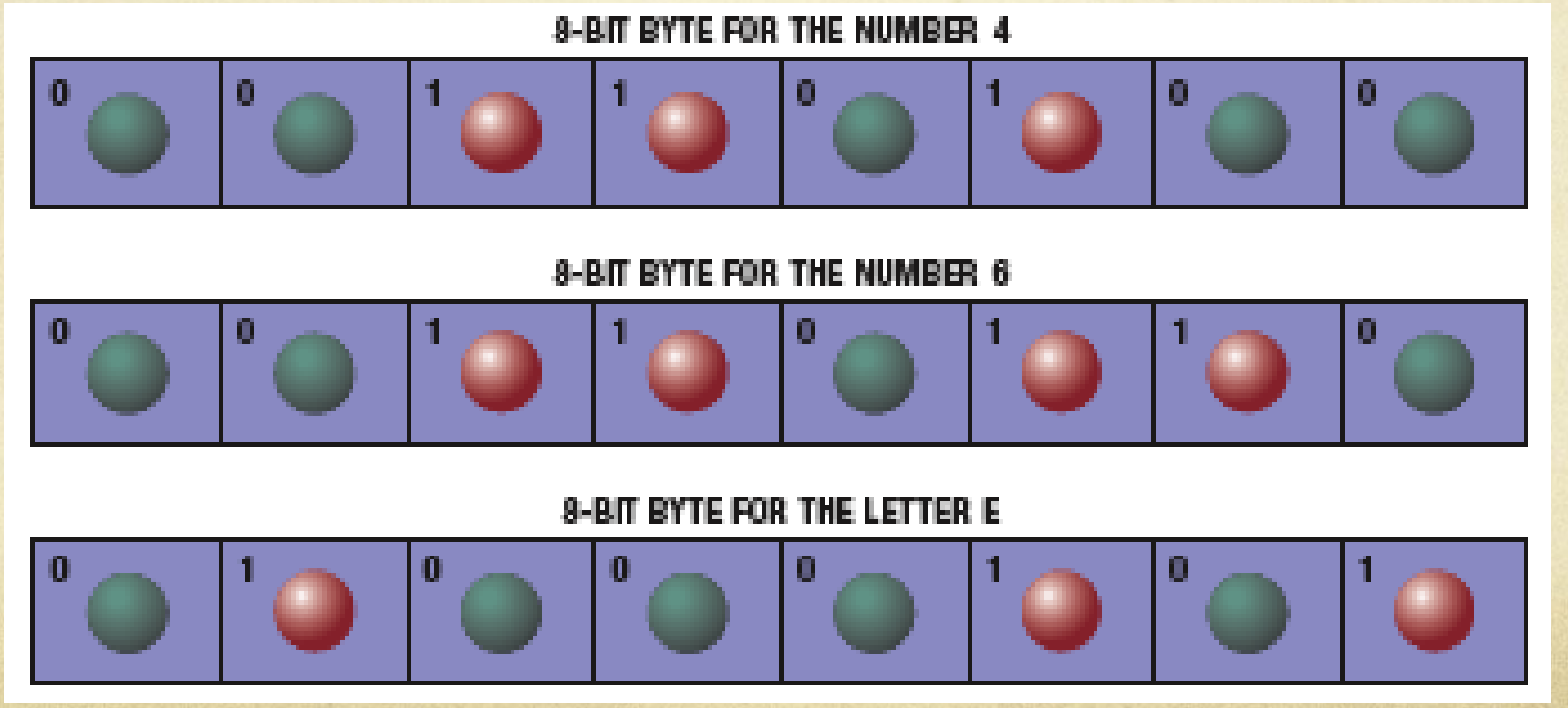
One byte represents 256 separate symbols or characters

Characters and symbols are defined using a coding scheme like ASCII

0011 0100 = 4

0011 0110 = 6

0100 0101 = E



Coding Schemes

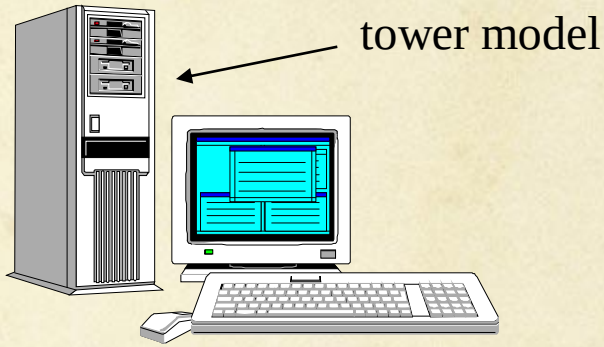
ASCII	SYMBOL	EBCDIC
00110000	0	11110000
00110001	1	11110001
00110010	2	11110010
00110011	3	11110011
00110100	4	11110100
00110101	5	11110101
00110110	6	11110110
00110111	7	11110111
00111000	8	11111000
00111001	9	11111001
01000001	A	11000001
01000010	B	11000010
01000011	C	11000011
01000100	D	11000100
01000101	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

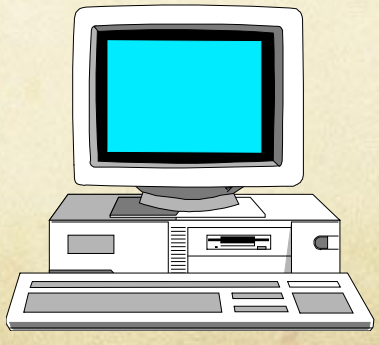
ASCII	SYMBOL	EBCDIC
01001110	N	11010101
01001111	O	11010110
01010000	P	11010111
01010001	Q	11011000
01010010	R	11011001
01010011	S	11100010
01010100	T	11100011
01010101	U	11100100
01010110	V	11100101
01010111	W	11100110
01011000	X	11100111
01011001	Y	11101000
01011010	Z	11101001
00100001	!	01011010
00100010	"	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



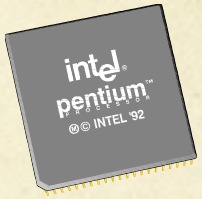


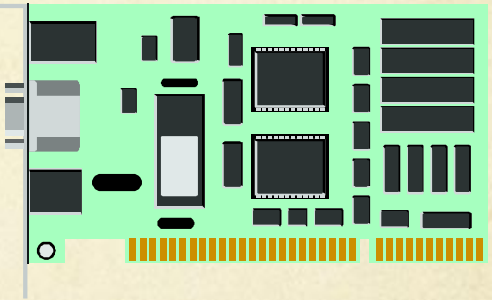
Motherboard

The main circuit board in the computer

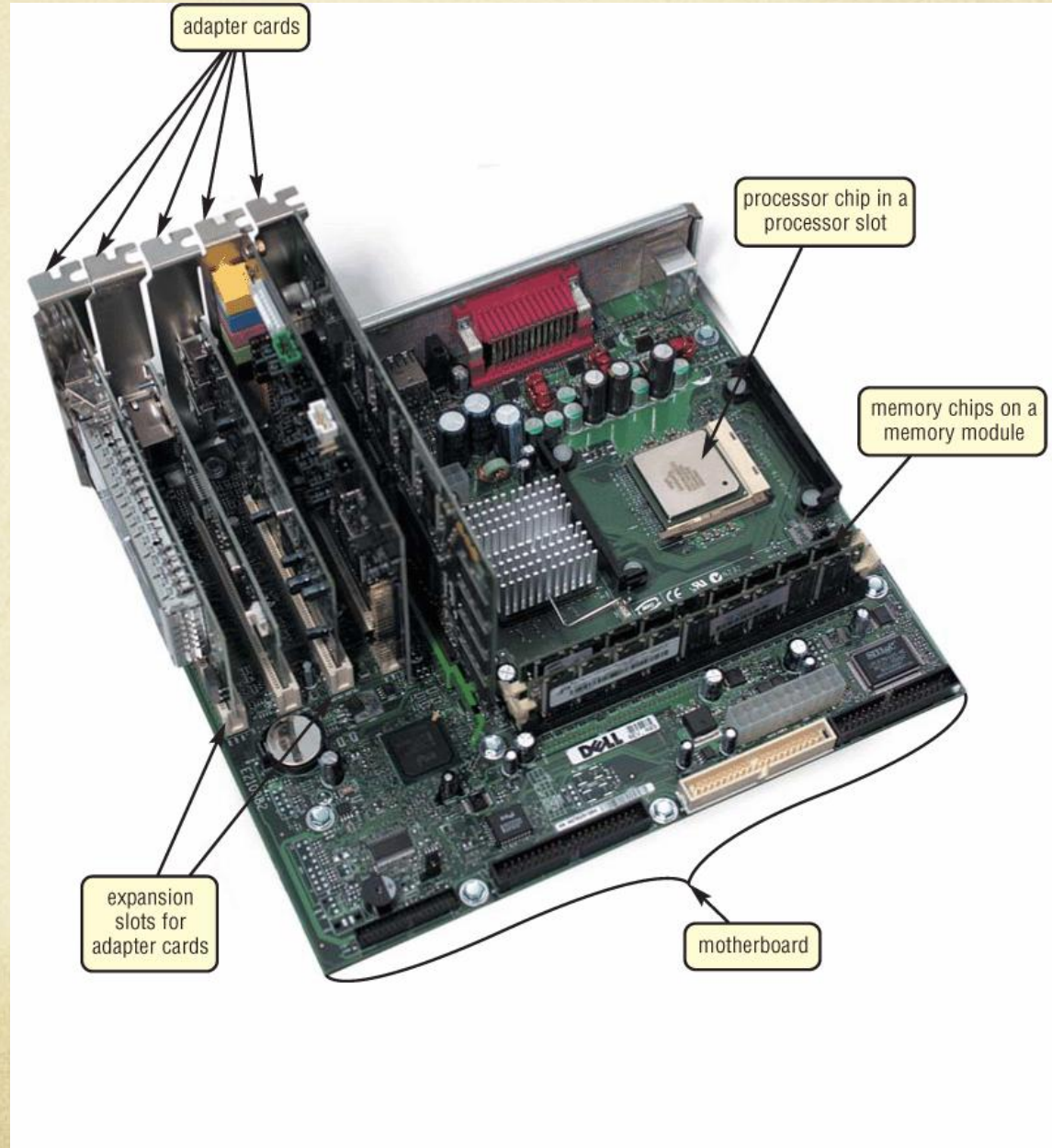
contains:

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



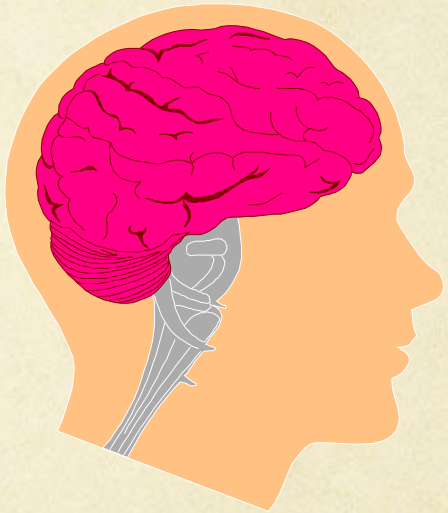


Motherboard



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:

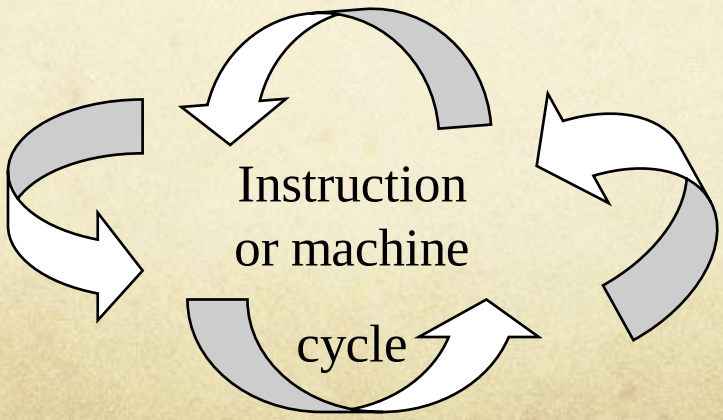
- The **Control Unit** coordinates and controls all parts of the computer.
- The **A**rithmetic **L**ogic **U**nit (ALU) performs the arithmetic, logical, and comparative operations.

  (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

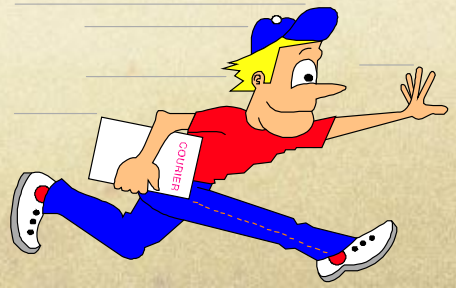
- Clock speeds are measured in gigahertz (billion ticks per second)

Speeding things up

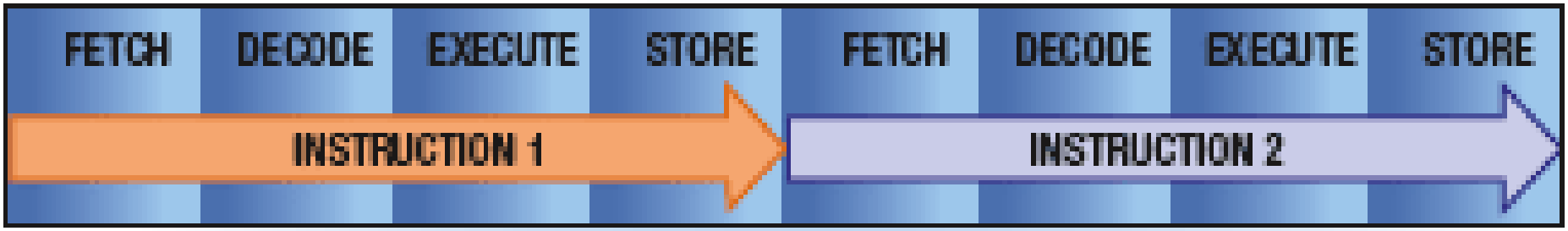
- **Pipelining –** CPU begins executing a second instruction before the previous instruction has completed its machine cycle.

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

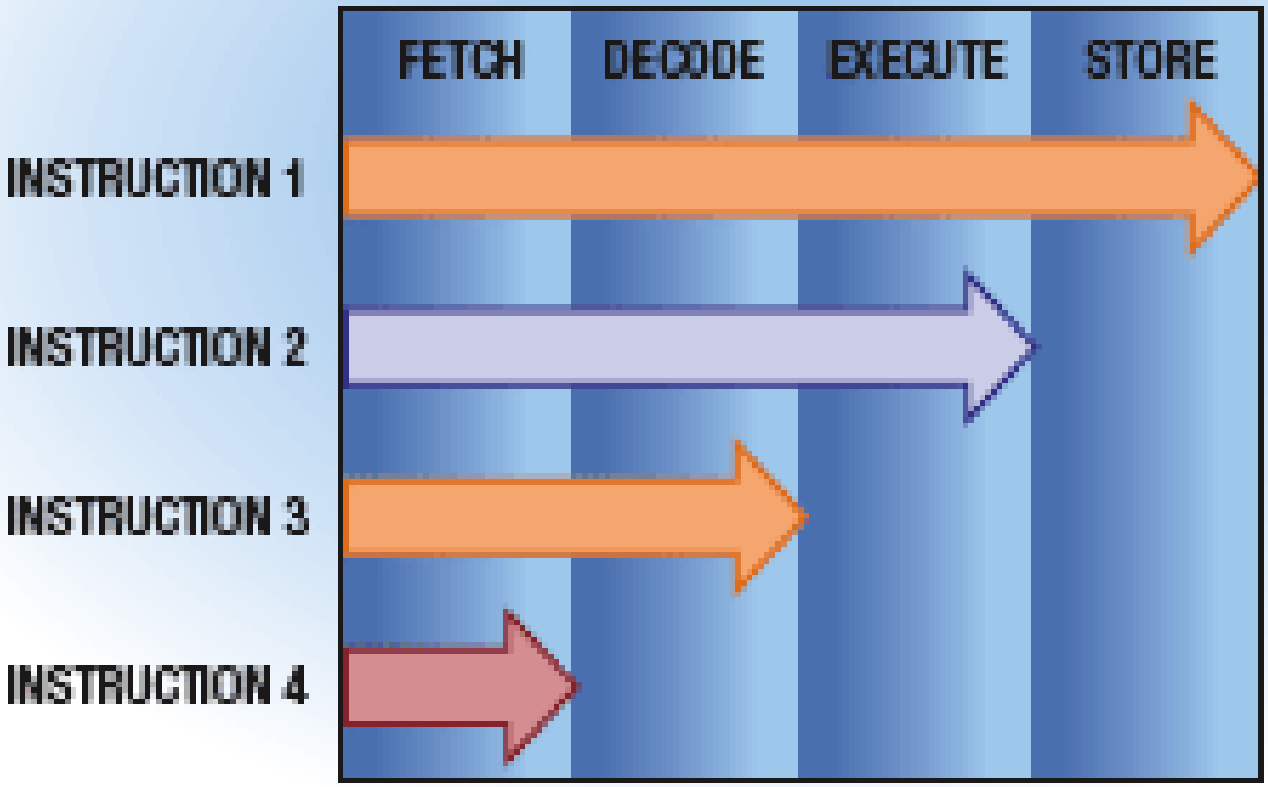
- **Parallel Processors –** Using more than one processor to divide up the work.



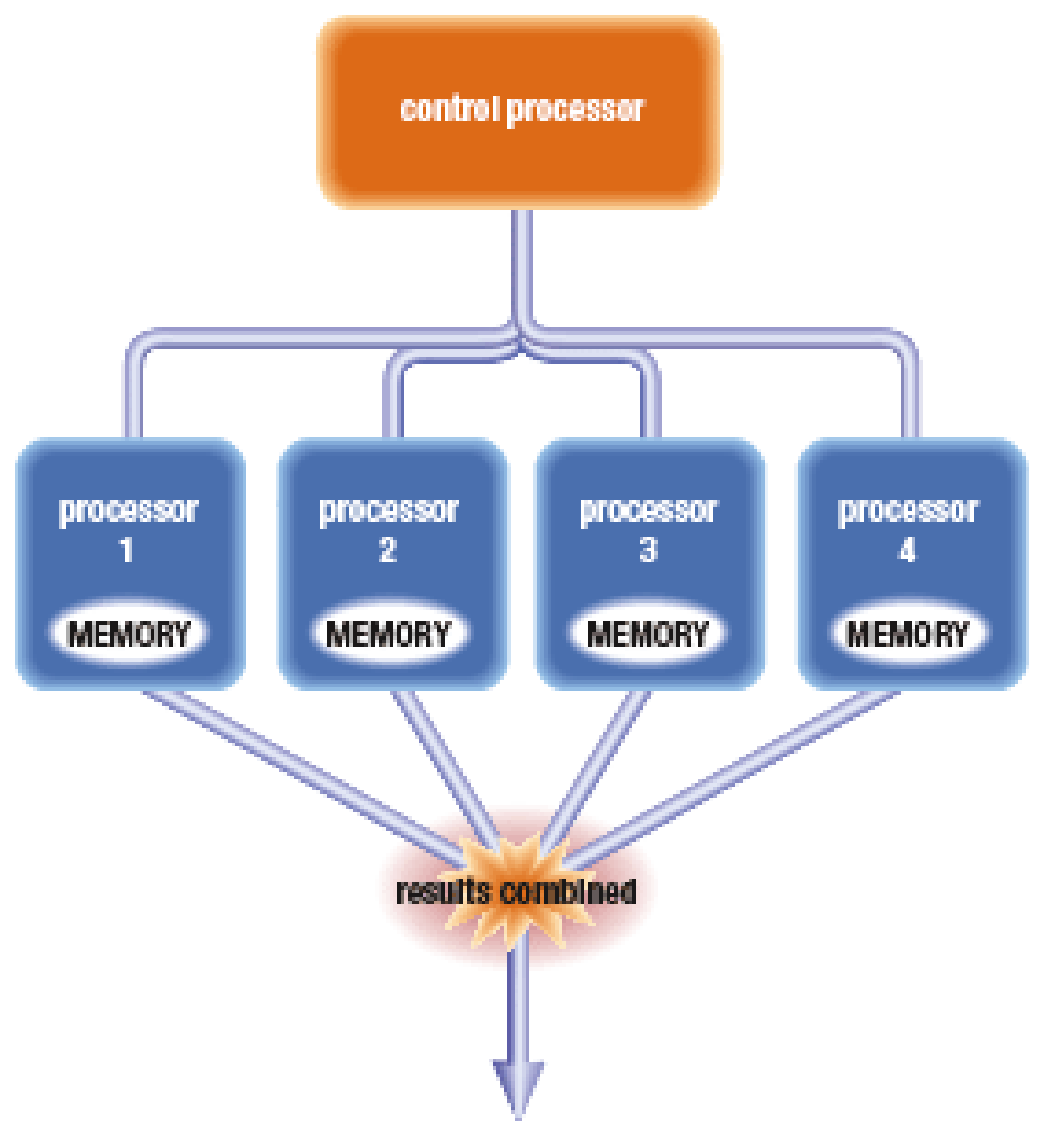
MACHINE CYCLE (without pipelining):



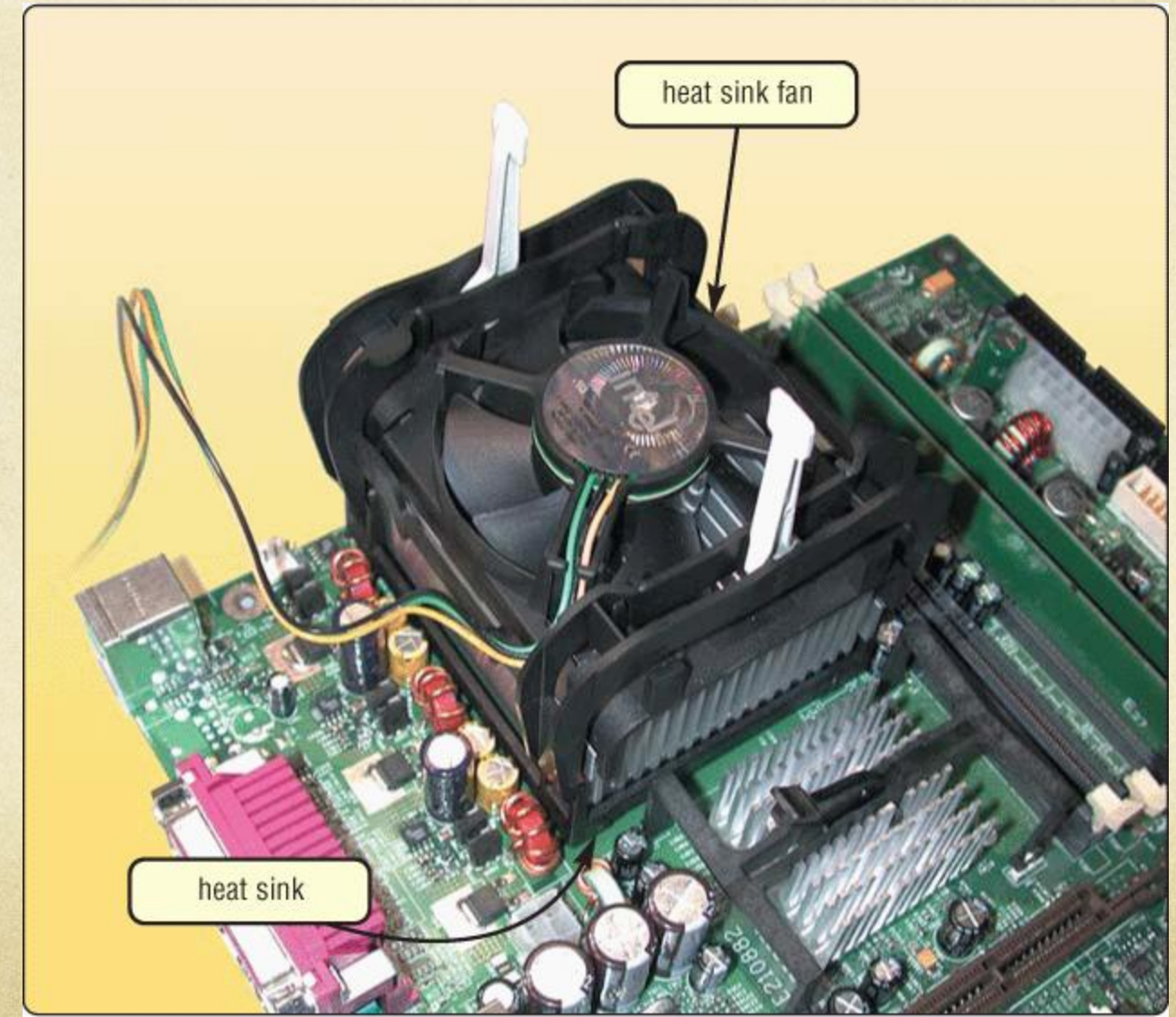
MACHINE CYCLE (with pipelining):



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

- Fill in the Decimal/Binary/Hexadecimal conversions table found in the instructor folder on the ECC intranet (instructions are also available on the homework page of the class website).
- You can create a "conversion cheat sheet" to help you if the concept of different number systems is confusing to you (you will be able to use this "cheat sheet" as part of your notes for the test).
- Read pages 36 – 38 in your book.