I.Ch 4 The System Unit

A.Competencies

1.Describe the three basic types of system units.

2.Discuss how a computer uses binary codes to represent data in electronic form.

3.Describe each of the major system unit components.

4.Explain the differences among the three types of memory.

5.Describe the five principal types of bus lines.

6.Discuss the most widely used types of ports.

B.Introduction

- Differences in microcomputer power focus on speed, capacity and flexibility.
- Competent end users need to understand the functionality of the basic components in the system unit, including the system board, microprocessor, memory, system clock, expansion slots and cards, bus lines, ports, cables, and power supply units.
- Some terms:
- Disk Drives: are secondary storage devices for saving data, programs, and information.
- Bus Lines: provide data pathways that connect various system components
- Power Supply Unit: converts Alternating Current (AC) to Direct Current (DC) providing power to the system unit.
- Systems Board: connects all system components to one another.
- System Unit: contains most of the computer's electronic components.
- Memory: holds data, instructions, and information, memory circuit boards plug into slots on the system board
- Microprocessor: controls operations and performs arithmetic and logical operations, microprocessor cartridges plug into a special slot on the systems board.
- Expansion Cards: allow external devices to connect to and expand a computer's capabilities, expansion cards plug into slots on the systems board.
- Expansion Slots: provide connections for expansion cards to the system board.

C. System Unit

- The **System unit** (aka **system cabinet** or **chassis**) is a container that houses most of the electronic components that make up a computer system.
- Three basic types for microcomputers include:
  - **Desktop system units**: contain the system's electronic components, and selected secondary storage. Input & Output devices like mouse, keyboard, monitor are located *outside* the system unit. It can be placed either *horizontally* or *vertically*. Vertical units are called "**tower models**".
  - **Notebook system units**: are *portable* and *much smaller*. They contain the electronic components, selected secondary storage and input devices (keyboard and pointing device). Monitor is located outside the system unit attached to it by hinges.
  - **Personal digital assistant (PDA) system units**: smallest and designed to fit into the palm of one hand. It contains the entire computer system including the electronic components, secondary storage and input and output devices

D. Electronic Data and Instructions

- Computers only recognize digital electronic signals.
- Much information comes via analog signals: continuous signals, which vary to represent different tones, pitches, and volume such as our voices.
- Computers must be able to convert analog signals to digital for processing.
- Computer data and information are represented electronically with a **binary**, or **two-state** system.
- Binary systems use only **two digits**, **0** & **1**.
- Each 0 or 1 is called a **bit** – short for binary digit.
- Bits are combined into groups of *eight bits* called **bytes** to represent numbers, letters and other characters.
- Each **byte** typically represents **one character**.

1. Binary Coding Schemes

Characters are represented as a series of bits through the use of a binary coding scheme. Popular schemes include:

- **ASCII**: American Standard Code for Information Interchange – the most widely used code for *microcomputers*. It typically uses an **8 bit** encoding scheme, enough to handle 2^8 (256) different characters. An example for the letter A is 0100 0001.
- **EBCDIC**: Extended Binary Coded Decimal Interchange Code – an **IBM** standard used for *large computers*. It also uses **8 bits**, but differs slightly from the ASCII coding scheme, e.g. A = 1100 0001
- **Unicode**: a **16 bit** (2 byte) code used to support international languages such as Chinese and Japanese that has too many characters that cannot be supported by 8-bit codes. It can represent 2^{16} characters (65,536 characters)

Chapter 4 The System Unit

When you press a key on the keyboard, the keyboard hardware sends an electronic signal to the system unit, converting the key such as the number 3 to the ASCII code of 0011 0011.

All instructions and data have to be converted into *binary data* before they can be executed. For example, instructions **3 + 5** require **24 bits** (*8 bits* X *3 characters*) using the ASCII coding scheme.

E. System Board

The system board *connects* all system components and allows input and output devices to communicate with the system unit.
- The **system board** is also known as **main board** or **motherboard**.
- It is the *communications medium* for the entire computer system.
- Every component of the system unit connects directly to the system board.
- It acts as the *data path* allowing the various components to communicate with one and another.

The system board is a large flat circuit board covered with sockets and other electronic parts including variety of chips:
- **Sockets**: provide a connection point for holding small specialized electronic parts called chips.
- **Chips** (aka **silicon chips**, **semiconductors**, or **integrated circuits**): consist of tiny circuit-boards etched on to squares of sand-like material called silicon. Chips are mounted on **carrier packages** that plug into sockets on the system board.
- **Slots**: provide a connection point for specialized cards or circuit boards.
- **Bus lines**: provide pathways to support communication among electronic components.

F. Microprocessor

- In a microcomputer, a **Central Processing Unit (CPU)** or **processor** is contained on a single chip called a **Microprocessor**.
- The microprocessor is often contained within a cartridge that plugs into the special slot on the system board. The microprocessor is the computer's "*brain*".

It has two basic components:
- **Control unit**: tells the rest of the computer system how to carry out a program's instructions. It directs the electronic signals between *memory* and the *ALU*, as well as between *CPU* and *input* and *output devices*.
- **Arithmetic-logic unit** (aka **ALU**): performs **arithmetic operations** – *addition, subtraction, multiplication* and *division*, and **logical operations** – *comparisons* such as equal to (=), less than (<) or greater than (>).

Chapter 4 The System Unit

1.Microprocessor Chips

Microprocessors capacities differ in terms of:
- **Word size** – the number of bits that can be accessed at one time by the CPU – typically 16, 32, or 64 bits. The more bits in a word, the more *powerful* – and the *faster* – the computer is. A 32-bit word computer can access 4 bytes at a time and a 64-bit word computer can access 8 bytes at a time and hence 64-bit computer is faster.
- **Speed** – how fast the microprocessor can process data and instructions – older microcomputers processed data in **microseconds**: *millionths of seconds*. Newer systems are faster and process data & instructions of *billionths of seconds*: **nanoseconds**.
- Supercomputers can process data in **picoseconds**: *trillionths of seconds*, 1,000 times as fast as a microcomputer.

There are two types of microprocessor chips:
- **Complex Instruction Set Computing** (**CISC**) chips: It is the most common type of microprocessor popularized by **Intel**. These are the most popular microcomputer CPU chips, sold by **Intel** – Pentium and Itanium, and **AMD** – Athlon and Hammer.
- **Reduced Instruction Set Computing** (**RISC**) chips: use *fewer instructions*, the design is *simpler* and *less costly* than CISC chops. Examples include the PowerPC chip produced by **Motorola**, the Alpha chip by **DEC**, SPARC chip by **Sun** Microsystems, MIPS chip by Silicon Graph's.

2.Specialty Processors

- **Smart cards**: a plastic card with the size of credit card with an embedded chip. They can store 80 times more information than contained in normal credit cards. They can record personal financial and medical information in encrypted or coded form by protecting it with passwords or pin number and hence they offer strong security and privacy.
- Co-processors: specialty chips designed to improve specific computing operations.
- Graphics coprocessors: handle the processing for displaying and manipulating 2-D and 3-D graphics images.
- Parallel processors: using specialized software, these are typically used in network servers and supercomputer systems.
- Visa, MasterCard, and American Express have introduced their smart cards to millions of users.

G.Memory

- Memory is a holding area for *data*, *instructions*, and *information*.
- Memory is contained on chips connected to the system board.

There are three well-known types of memory chips:

1.Random Access Memory (RAM)

- RAM chips hold the program instructions and data that the CPU is currently processing.
- RAM is called **temporary** or **volatile** storage, because the contents are lost when the microcomputer is turned off. This differs from secondary storage which is **permanent** or **non-volatile**: it retains the contents when the power is switched off as happens to data stored on *diskettes*. It is a good idea to save your work on secondary storage very often. Data from secondary storage must be loaded into RAM before it can be used.
- **Flash RAM** (aka **Flash memory**) is a new type of RAM that is *non-volatile* and can retain data even if power is switched off. This type of memory is *more expensive* are used in digital cell phones, digital cameras, and some portable computers.
- It is important to have enough RAM.
- If your computer does not have enough RAM to hold a program some operating systems allow you to run the program using **virtual memory**, in which large programs are divided into parts and stored on a secondary storage each part is then "swapped" in and out of secondary storage as needed.
- **Cache memory** (aka RAM cache) is a special high speed area of memory that holds information that is used most frequently. Having cache memory can speed up the processing time for your computer.
- Other types of RAM include DRAM, SDRAM.

2.Read Only Memory (ROM) (aka Firmware)

- Programs are built into these chips in the factory.
- ROM chips are **non-volatile** and cannot be changed by the user.
- "Read-only" means that the CPU can read the programs written on the ROM chip but the computer cannot write information or instructions in ROM.
- ROM chips usually contain special instructions for detailed computer operations like instructions for starting the computer, for displaying characters on the screen.
- ROM chips are also called **firmware**.

3.Complementary Metal Oxide Semiconductor (CMOS)

- CMOS chips provide flexibility and expandability for a computer system. It contains essential information that is required every time the computer is turned on.
- CMOS chips typically hold 64 bytes of data including the current data & time, amount of RAM, type of keyboard, etc.

- CMOS chips are powered by a battery, and don't lose their contents when the AC power is turned off unlike RAM.
- Unlike ROM, CMOS chips can have their contents changed to update changes in computer system like increased RAM and new hardware devices.

H. System Clock

- The system clock is located on a small, specialized chip that produces precisely timed electrical beats or pulses.
- The microprocessor uses the clock beats to coordinate and synchronize all computer operations.
- The **clock's speed** (aka **clock rate**) is typically measured in **gigahertz**, or billions of beats per second.

I. Expansion Slots and Cards

- Computers are designed based on different "architectures"
- A **closed architecture** means that you generally can not add new devices.
- An **open architecture** allows you to expand the system by providing slots on the system board in which one can insert optional devices known as expansion cards.
- Expansion slots provide an open architecture.
- **Expansion cards** are also called **plug-in boards**, controller cards, adapter cards, and interface cards. Some of the most common cards are:
  - **Video cards** (aka **graphics cards**) connect the system board with the computer's monitor to convert the internal electronic signals to video signals so they can be displayed on the monitor.
  - **Sound cards** accept audio input from a microphone and convert it to a form that can be processed by the computer and vice-versa.
  - **Modem cards** (aka **internal modems**) allow computers to communicate with each other by converting electrical signals from within the system unit into electrical signals that can travel over telephone lines and other types of connections.
  - **Network Interface Cards** (NICs aka **Network Adapter Cards**) connect a computer to one or more other computers forming a network where by users can share data, programs, and hardware, e.g. an Ethernet network
  - **TV tuner cards** (aka television boards, video recorder cards, or video capture cards) allow you to watch TV on your computer as well as capture video input.
  - **Plug and Play** is a set of hardware and software standards developed in part by Intel and Microsoft to create operating systems, processing units, expansion boards, as well as other devices, to automatically configure themselves so they work with your computer.
  - **PC cards** (aka PCMCIA Personal Computer Memory Card International Association cards) are credit card sized adaptors that connect portable computers to various external devices, e.g. a PCMCIA Ethernet card.

J.Bus Lines (aka Data Bus or Bus)

- The bus connects the parts of the CPU to each other and also links the CPU to various other components on the system board.
- The number of bits that can pass down the bus is called the **bus width**.
- The more the bus width the faster the processing speed.
- Typical bus widths are 32 or 64 bits.
- A system unit has more than one type of bus line. The principal bus lines are:
    - **Industry Standard Architecture (ISA) bus**: originally an 8 bit bus designed for the first IBM PCs. Now it is a 16 bit bus and still found on some microcomputers though it is slow.
    - **Peripheral Component Interconnect (PCI) bus**: originally developed for video demands of graphical user interfaces, a high-speed 32-bit or 64-bit bus that is over 20 times faster than the older ISA buses.
    - **Accelerated Graphics Port (AGP) bus**: over twice as fast as PCI buses. Widely used for acceleration of graphics performance, 3-D animation, and the transfer of video data.
    - **Universal Serial Bus (USB)** combines with a PCI bus on the system board to support several external devices without using expansion cards or slots. USB buses are widely used to support high-speed scanners, printers and video-capturing devices.
    - **High Performance Serial Bus (HPSB)** (aka **Fire Wire bus**) operate much like USB buses but at higher speeds and are typically used to connect digital camcorders.

K.Ports

- A **Port** is a socket for external devices to connect to the system unit.

1.Standard Ports

- **Serial ports**: used to connect a mouse, keyboard, modem, etc. Send data **one bit at a time**. Good for sending data over a *longer distance*.
- **Parallel ports**: used to connect external devices that need to send or receive a lot of data over a short distance, such as printers. Sends eight bits of data at a time across eight parallel wires.
- **USB Ports**: gradually replacing serial and parallel ports. They are faster and one USB port can be used to connect several devices into the system unit.
- **FireWire Ports** (aka **HPSB**): are faster than USB ports and typically used to connect video devices to a computer.

2.Cables

- **Cables** are the "wires" to connect external devices to the system unit via the ports.

L.Visual Summary at a glance *The System Unit* page 168

1.System Unit

a)Electronic Representation

b)Binary Coding Schemes

2.System Board

3.Microprocessor

a)Microprocessor Chips

b)Specialty Processors

4.Memory

a)RAM

b)ROM

c)CMOS

5.System Clock

6.Expansion Slots and Cards

7.Bus Lines

a)Expansion Buses

8.Ports

a)Standard Ports

b)Cables

9.Power Supply

M.Key Terms page 171

1	AC adapter		aka power supply; converts Alternating Current from a wall outlet into Direct Current (DC) the computer needs
2	accelerated graphics port	AGP	special circuitry that is twice as fast as the PCI bus for improving graphics performance on a computer
3	adapter card		aka controller card; an additional circuit board for a computer to add such things as networking capability
4	alternating current	AC	electricity from a standard wall outlet
5	analog		a continuous signal, such as that made by our voice
6	arithmetic operation		a fundamental math computation such as addition, subtraction, multiplication or division
7	arithmetic-logic unit	ALU	the circuitry on a computer chip that performs math and comparison operations
8	ASCII		American Standard Code for Information Interchange; converts characters into a series of bits
9	binary coding scheme		generic term for a standard to convert characters into a series of bits
10	binary system		a two number counting system, uses 1s and 0s and is the basis for digital computer systems
11	bit		acronym for Binary Digit; the smallest unit of data storage on a computer
12	bus		aka bus line; a wired connection between components in a computer
13	bus line		aka bus; a wired connection between components in a computer
14	bus width		the number of wires on the bus, e.g. 8 bit bus, 16 bit bus, etc. the more bits, the more information the bus can pass
15	byte		typically a group of 8 bits, often used to represent 1 character
16	cable		a covered electrical pathway (one or more wires) to connect components in a computer system
17	cache memory		special high speed memory location to store recently used data or instructions
18	carrier package		the component used to house a computer chip for mounting it in a computer
19	central processing unit	CPU	the main system chip which processes data in a computer
20	chassis		aka system unit or system cabinet; houses a computer's components
21	chip		a silicon chip used to etch computer circuitry on - typically used for CPUs or memory
22	clock rate		aka clock speed; the number of beats per second issued by a quartz clock for timing the electrical impulses in a computer
23	clock speed		aka clock rate; the number of beats per second issued by a quartz clock for timing the electrical impulses in a computer
24	closed architecture		systems that are manufactured so it is difficult to modify or add new devices - typically run faster, and are cheaper to build
25	complementary metal-oxide semiconductor chip	CMOS	type of memory chip that gives the designer flexibility & expandability; the contents of these chips can be changed
26	complex instruction set computer chip	CISC	a common design for CPU chips, used by Intel and other manufacturers
27	control unit		the circuitry on a computer chip that controls the overall processing operations
28	controller card		aka expansion card; an additional circuit board for a computer to add such things as networking capability
29	convertible tablet PC		a notebook computer with a monitor that swivels and folds onto it's keyboard
30	coprocessor		specialty chips designed to improve specific computing operations
31	desktop system unit		aka system unit or system cabinet; houses a computer's components
32	digital		system that works with discreet signals, either on or off, used for most computer systems
33	direct current	DC	electricity from a battery or AC adapter used by the computer circuitry
34	EBCDIC		Extended Binary Coded Decimal Interchange Code; an encoding scheme from IBM to convert characters to bits
35	expansion bus		aka bus line; a wired connection between components in a computer
36	expansion card		aka interface card; an additional circuit board for a computer to add such things as networking capability

37	expansion slot		area on a circuit board that allows you to connect another board to it
38	FireWire bus		type of wired connection to the main system board, typically used for importing digital video
39	FireWire port		the connecting point to hook up a cable to a peripheral device using this kind of connection
40	firmware		software that is "burned on" to a ROM chip
41	flash memory		special memory chip that provides electronic memory that can maintain it's contents even after the power is switched off
42	flash RAM		special memory chip that provides electronic memory that can maintain it's contents even after the power is switched off
43	gigahertz	GHz	measurement of CPU or bus speeds, billions of cycles per second
44	graphics card		specialized circuit board for controlling the monitor
45	graphics coprocessor		specialized chip to enhance video output to the monitor
46	handheld computer system unit		"Palm" type device for hand held computing
47	high performance serial bus	HPSB	aka firewire bus - high speed connection for applications such as video editing
48	high performance serial bus port	HPSB port	aka firewire bus port - where you plug the cable in
49	industry standard architecture	ISA	standard used to set the connection criteria for adding circuit boards to a computer - an older standard
50	integrated circuit		aka semiconductor; the circuitry for a processor or memory etched on a sliver of silicon
51	Intel-compatible		refers to those CPU chips that are either manufactured by Intel, or those companies copying their products
52	interface card		aka plug-in board; an additional circuit board for a computer to add such things as networking capability
53	internal modem		a circuit board housed inside the system cabinet to translate digital signals to analog phone signals and back again
54	laptop		aka notebook; smaller microcomputer system that fits in a briefcase
55	logical operation		a comparison operation; < > and or; carried out by the CPU
56	main board		aka motherboard; contains all the main circuitry of the computer, e.g. CPU and memory, ROM, battery, etc.
57	memory		specialized chips to hold electronic contents for the computer
58	microprocessor		literally a "computer on a chip" - the entire processing circuitry all on one chip
59	microsecond		measurement of time, 1/1,000,000 of a second
60	modem card		a circuit board housed inside the system cabinet to translate digital signals to analog phone signals and back again
61	motherboard		aka system board; contains all the main circuitry of the computer, e.g. CPU and memory, ROM, battery, etc.
62	nanosecond		measurement of time, 1/1,000,000,000 of a second, used to measure CPU speeds
63	network adapter card		aka network interface card; specialized circuit board for controlling access to a wired or wireless network
64	network interface card	NIC	aka network adapter card; specialized circuit board for controlling access to a wired or wireless network
65	nonvolatile storage		storage that does not lose it's contents when power is turned off
66	notebook system unit		aka laptop; smaller microcomputer system that fits in a briefcase
67	open architecture		systems that are manufactured so it is easier to modify or add new devices
68	palm computer		aka handheld computer; type device for hand held computing
69	parallel port		connection to a computer where multiple wires send data at the same time - often used for printer connections
70	parallel processing		running multiple CPUs at the same time to increase processing speed and power of a computer
71	parallel processor		running multiple CPUs at the same time to increase processing speed and power of a computer
72	PC card		aka PCMCIA card; an additional circuit board for a laptop computer to add such things as networking capability
73	peripheral component interconnect	PCI	aka PCMCIA card; an additional circuit board for a laptop computer to add such things as networking capability
74	Personal Computer Memory Card	PCMCIA	aka PCMCIA card; an additional circuit board for a laptop computer to add such things as networking capability

75	International Association card personal digital assistant	PDA	aka handheld computer; type device for hand held computing
76	picosecond		measurement of time, 1/1,000,000,000,000 of a second, used to measure supercomputer speeds
77	Plug and Play		standard from Microsoft and Intel to make it easier to add new computer devices
78	plug-in board		aka adapter card; an additional circuit board for a computer to add such things as networking capability
79	port		connecting point between a computer and an external cable
80	power supply unit		aka AC adapter; converts Alternating Current from a wall outlet into Direct Current (DC) the computer needs
81	processor		chip that processes data and instructions in a computer
82	RAM cache		special high speed memory location to store recently used data or instructions
83	random-access memory	RAM	special chips to hold electronic contents of memory for the CPU to process
84	read-only memory	ROM	special chips to hold programs
85	reduced instruction set computer chip	RISC	chip design that simplifies the instructions and processes data quickly - often used by UNIX hardware systems
86	semiconductor		aka silicon chip; the circuitry for a processor or memory etched on a sliver of silicon
87	serial port		connection point for keyboards and mice - sends data 1 bit at a time.
88	silicon chip		aka integrated circuit; the circuitry for a processor or memory etched on a sliver of silicon
89	slate tablet PC		similar to a notebook except that its monitor is attached to the system unit and does not have a keyboard
90	slot		place where an adapter card is inserted into the main system board
91	smart card		credit cards with an embedded chip
92	socket		connection on circuit board onto which you plug a chip or other device
93	system board		aka main board; contains all the main circuitry of the computer, e.g. CPU and memory, ROM, battery, etc.
94	system bus		the main bus on the motherboard - wired pathway to connect the CPU with memory and other key components
95	system cabinet		the housing for the computer components - boards, power supplies, etc.
96	system clock		electronic timing device for chips in the computer
97	system unit		the housing for the computer components - boards, power supplies, etc.
98	tablet PC		type of microcomputer with a digitizing screen for input - about the size of a laptop
99	tablet PC system unit		type of microcomputer with a digitizing screen for input - about the size of a laptop
100	television board		circuit board so you can watch TV and capture video on a computer
101	tower model		housing unit for computer boards - sits upright along side a desk
102	TV tuner card		expansion card that allows you to watch & capture television on a computer
103	two-state system		an "on/off" system - the binary system
104	Type I card		Type I cards can be up to 3.3 mm thick, and are used primarily for adding additional ROM or RAM to a computer
105	Type II card		Type II cards can be up to 5.5 mm thick. These cards are often used for modem and fax modem cards.
106	Type III card		Type III cards can be up to 10.5 mm thick, which is sufficiently large for portable disk drives.
107	Unicode		encoding scheme to convert characters to bits using 16 bits per character
108	universal serial bus	USB	high speed pathway to connect newer computer devices such as a mouse, keyboard, external hard drive, etc
109	universal serial bus port	USB port	where a USB device gets plugged in
110	video capture card		circuit board so you can watch TV and capture video on a computer
111	video card		specialized circuit board for controlling the monitor
112	video recorder card		circuit board so you can watch TV and capture video on a computer
113	virtual memory		area on a storage device which can act as memory
114	volatile storage		electronic storage that loses the contents when power is off
115	word		the number of bits (16, 32, 64) that can be accessed by the CPU at one time
116	workstation		powerful, single user computer typically used for engineering and visualization applications

N.Chapter Review

1.Crossword page 172

a)Across

7	PLUGANDPLAY	Assists with the installation of expansion cards
9	CLOSED	Type of architecture that users cannot easily add devices to
12	ASCII	Most widely used microprocessor binary coding scheme
13	SYSTEMCLOCK	Controls the speed of operations
15	MEMORY	Holding area for data, instructions, and information
16	CABLE	Used to connect external devices to system unit via ports

b)Down

1	GRAPHICSCARD	Connect the system board to a computer's monitor
2	WORD	The number of bits that can be accessed by the microprocessor at one time
3	FIRMWARE	Another name for ROM chips
4	CHASSIS	Container that houses most electronic computer components
5	SOCKETS	Provide connection points for chips
6	BUS	Connects the parts of the CPU to each other
8	RAMCACHE	Temporary high-speed holding area between the memory and CPU
10	BUSWIDTH	The number of bits that can travel simultaneously down a bus
11	BIT	Binary digit
12	AGP	Over twice as fast as the PCI bus
14	SLOT	Connection point for specialized cards or circuit boards

2.Multiple Choice page 173

1	C	System cabinet and chassis
2	C	PDAs
3	C	Binary coding schemes
4	A	Slots
5	B	Temporary
6	B	Clock speed
7	E	Firmware
8	D	CMOS
9	A	Plug and Play
10	E	Bus line

3.Matching page 174

TERM	MATCH	NUMBER	HINT
system unit	T	1	Houses most of the electronic components in a computer system
bus width	B	2	The number of bits that can travel down a bus at the same time
system board	R	3	The communications web for the entire computer system
chip	E	4	Consists of a circuit board etched on a stamp-sized square of silicon
control unit	H	5	Tells the rest of the computer system how to carry out a program's instructions
analog	A	6	Type of signal created by our voices
CISC chip	F	7	The most common type of microprocessor
smart card	Q	8	A credit card size piece of plastic with an embedded chip

RAM	P	9	Volatile storage that holds the program and data the CPU is currently processing
cache memory	D	10	Fast, temporary high-speed holding area between the memory and the CPU
system clock	S	11	Produces precisely timed electrical beats as a timing mechanism
closed architecture	G	12	Machines that users cannot easily add new devices to
expansion card	I	13	Also called plug-in boards, controller cards, adapter cards, and interface cards
firmware	K	14	Also called ROM
PC card	N	15	Credit card-sized expansion boards used by portable computers
graphics coprocessor	L	16	Handles computations related to graphics images.
port	O	17	Connecting socket on the outside of the system unit.
parallel port	M	18	Connects external devices that need to send or receive a lot of data over a short distance
flash RAM	J	19	Another name for flash memory
cables	C	20	Connects input and output devices to the system unit via the ports

4.Open-ended

a)Describe the four basic types of system units.

- Desktop:
- Notebook:
- Tablet PC:
- Handheld:

b)Describe the two basic components of the CPU.

- Control unit:
- Arithmetic Logic Unit:

c)What are the differences and similarities between the three types of memory?

- Three types include:
- RAM: high speed, volatile
- ROM: high speed, save info when powered down, can't change contents
- CMOS: high speed, saves info, but can be changed

d)Identify four expansion cards and describe the function of each.

- Video:
- Modem:
- NIC:
- TV Tuner:
- PC cards (PCMCIA):

e)Identify and describe four standard ports:.

- Serial:
- Parallel:
- USB:

- FireWire:

O.Using Technology page 175

1.TV Tuner Cards and Video Clips

- This section briefly describes how to set up a TV Tuner Card on your PC

2.Desktop and Notebook computers

- This section asks students to compare the advantages and disadvantages of buying a desktop vs. a notebook computer.

P.Expanding Your Knowledge page 176

1.How TV Tuner Cards Work

- Review the animation "How TV Tuner Cards Work" via the text's CD and/or Web site

2.How Virtual Memory Works

- Review the animation "How Virtual Memory Works" via the text's CD and/or Web site.

Q.Building Your Portfolio page 177

1.Microprocessors

- Research the latest microprocessors from industry leaders such as Intel and AMD.
- May recommend that students research the microprocessor industry online, e.g. http://finance.yahoo.com

2.Processor Serial Numbers

- Intel Pentium III microprocessors originally had a unique serial number stamped on it.
- What advantages and disadvantages might this cause – think in terms of tracking and privacy issues…

II.Concept Checks at a glance

A.Ch 6 page 151

1.What is the system unit?

- The system unit houses the internal electronic components that make up a computer system
- It is also known as the system cabinet or chassis
- Some of the main components in it include the motherboard, a power supply, storage drives, and ports to connect external input, communication, and output devices

2.Describe the four basic types of microcomputer system units.

- Desktop (or Tower) system units: typical computer configuration meant to stay on or near a desk; tends to cost less than other systems with similar power. Easiest to expand, but lack portability
- Notebook (or laptop) systems: about the size of a small pizza box, is portable and often as powerful as desktop configurations
- Tablet PCs: a laptop with a digitized writing surface that will recognize handwriting
- Handheld computer systems: small, less powerful systems, but they fit in the palm of your hand. Also know as PDA – Personal Digital Assistants

3.What are the three basic system components that are common to all system units.

- System board
- Microprocessor
- Memory

B.Ch 6 page 154

1.What are decimal and binary number systems? How are they different?

- The decimal number system (base 10) is what people are most familiar with. It uses ten digits, 0-9, to represent numeric quantities
- The binary number system (base 2) is a two digit system, and uses just 0-1 for representing numeric quantities.
- The binary system is used to represent how computers process information – most modern computers use a digital or two-state system to represent data and process it.

- An example for these systems: the number 13 in decimal is 1101 in binary.

2. What are binary coding schemes. Name and describe three.

- Binary coding schemes are used to represent characters in a numeric format that can be processed by a digital computer.
- ASCII – American Standard Code for Information Interchange – an 8 bit scheme that can represent $2\char`^8{}^{th}$ different characters (256). It is often used on microcomputers.
- EBCDIC – Extended Binary Coded Decimal Interchange Code is also an 8 bit code created by the IBM Corporation, and typically used on mainframe computers
- Unicode – a 16 bit encoding scheme that can represent $2\char`^16{}^{th}$ different characters (65,536), therefore it can be used for international languages such as Chinese and Japanese

3. Describe how ASCII code is used to represent numbers and letters.

- ASCII uses 8 bits, for example the letter "A" is represented using the digits 0100 0001, "B" = 0100 0010 and so on.

C. Ch 6 page 155

1. What is the system board and what does it do?

- The system board for a microcomputer is the main circuit board in the computer.
- It connects all the key components of the computer, including the CPU, ROM, RAM, slots for expansion cards, power, etc.

2. Define and describe sockets, slots, and bus lines.

- A socket is used to connect a chip onto the motherboard
- A slot is used to connect an addition circuit board, e.g. a Network Interface Card, onto the mother board
- Bus lines are the "wires" that connect various chips and components on the circuit boards

3. What are chips? How are chips attached to the system board?

- Chips are small pieces of silicon that are etched with circuitry to perform various functions, such as to act as a memory chip, or as a microprocessor chip.
- They are inserted into a carrier package, a plastic casing that protects the chips, and has metal leads to connect it with a circuit board.

- The carrier package is inserted into a socket on the circuit board.

D.Ch 6 page 158

1.Name and describe the two components of a microprocessor.

- The CPU is made up of:
- A control unit, which tells the rest of the computer system how to carry out the program's instructions. It directs the movement of electronic signals between memory and the ALU.
- The ALU (Arithmetic Logic Unit) performs the math and comparison operations for the processor.

2.Name and describe the two types of microprocessor chips.

- Two common chip architectures (their fundamental design) include:
- CISC – Complex Instruction Set Computing: used by Intel and Intel compatible microprocessor manufacturers, they have a larger instruction set – these have been the most popular microprocessor chips for personal computers
- RISC – Reduced Instruction Set Computing: used by companies such as Motorola and Sun, they are designed to use a simplified instruction set, but can process information at high speeds. These chips were often used in servers and workstations.
- Intel compatible chips are produced by companies like AMD – Advanced Micro Devices, as a cost effective competitor to Intel

3.What are specialty chips? Name and discuss two types of specialty processors.

- Microprocessors can be designed for a number of purposes, including those found in microwave ovens, automobiles, telephones, etc. Three common types include:
- Graphics coprocessors: speed up the performance of your computer monitor
- Parallel processors: run large programs or process lots of data quickly, often found in powerful servers
- Smart cards: embedded in credit cards, they can offer additional security, and be programmed to do various functions such as storing coupons, small amounts of cash, etc.

E.Ch 6 page 159

1.What is memory? Name and describe the three types of memory chips.

- Memory is high speed electronic storage for a computer. Three types of memory chips include:
- RAM – Random Access Memory – used to hold data and instructions for the active application program. It is volatile memory, meaning if the power is lost, the contents are also.
- ROM – Read Only Memory – used to store permanent System information. Programs can be "burned in" during the manufacturing process, to provide quick, reliable loading of key features.
- CMOS – Complementary Metal Oxide Semiconductor chips are used to store programs that change on occasion, such as the computer's BIOS – Basic Input Output System.

2.Define cache memory.

- A special high speed memory area, that stores the most recently used data and instructions.
- The advantage with cache is it speeds up the processing of data. The disadvantage is it adds to the cost of the computer.

3.Define flash RAM.

- Flash RAM is a special type of memory that is not volatile, but it can be changed.
- It is often used for special applications such as in digital cell phones.

4.Define virtual memory.

- Virtual memory breaks a program into parts and stores some on a secondary storage device and brings it back into memory when needed.
- It helps to expand the ability of a computer to handle larger programs.

F.Ch 6 page 160

1.What is a system clock? How is it like a bass drum?

- The system clock is a small, specialized chip that times the electrical impulses to pace the flow of bits through the system
- It works like a bass drum in that it "sets the beat".

2.What is clock speed? How is it measured?

- Clock speed is how fast these beats occur.

- Clock speeds are typically measured in MHz or GHz – Millions or Billions of cycles per second.

G.Ch 6 page 164

1.What does open versus closed architecture mean?

- The architecture of a system is the basic design.
- An open system means that it is fairly easy to upgrade the system – you can add more memory, devices, etc.
- A closed system means it isn't easy to upgrade – it usually holds down the cost to build the system.

2.What are expansion slots and cards? Name four (types of) expansion cards.

- Expansion slots are the openings/connectors on a main board for additional circuit boards to be connected.
- An expansion card is the additional circuit board
- Several types of expansion/adapter cards include:
  - Video cards: connect to the monitor
  - Modem cards: allow communication via phone lines
  - Network Interface cards (NIC): allow connection via network cable e.g. an Ethernet card
  - TV tuner cards: allow a user to watch and capture television on a computer

3.What is Plug and Play? What are PC cards?

- Plug and Play is a standard used to make it easier to add an expansion card to a computer.
- Once you add a device, the computer "senses it" and installs the proper software to use it.
- PC cards (aka PCMCIA cards): connect to laptops.

H.Ch 6 page 166

1.What is a bus and what is its function?

- A bus (aka bus line) connects the parts of the CPU to each other. They are the printed wires on a circuit board used to transfer data.
- Five common bus lines include:
  - ISA – Industry Standard Architecture – older, slower technology, but still found on microcomputers
  - PCI – Peripheral Component Interconnect – faster than ISA bus
  - AGP – Accelerated Graphics Port – faster than PCI for video data

> - o USB – Universal Serial Bus – used to connect various external devices such as keyboards, mice, printers, hard drives
>   - o FireWire (HPSB) – also used to connect external devices, especially digital video recorders

2.What are ports? What do they do? Describe four standard ports.

> - A port is a connecting point for external devices to attach to a computer
> - Four standard types include:
>   - o Serial ports: typically 9 pin female ports for connecting a mouse or keyboard
>   - o Parallel ports: typically a 32 pin female port for connecting a printer
>   - o USB ports: newer type for connecting keyboards, printers, etc.
>   - o FireWire ports: newer type to transmit lots of data quickly, typically used to connect digital video cameras to a computer.

3.What is a power supply unit? What is an AC adaptor?

> - A power supply provides a computer with electrical power in the correct voltage and wattage that it needs.
> - An AC adaptor will convert Alternating Current (from a standard 120 volt socket) to Direct Current that the system components need.
> - Desktops typically have a built in power supply that converts AC to DC power. It often has a fan to help cool the computer so it doesn't overheat and fail.
> - Notebook computers typically have an AC adapter to convert from AC to DC power, and are also used to re-charge the notebooks battery.
> - Handheld computers typically are powered by a battery, which can be recharged by an AC adapter.

III.List of Figures at a glance

- Ch 6 page 150 figure 6-1 Basic types of system units
  - o Photos of four types microcomputers including:
    - Desktop (tower model): a Sony Vaio
    - Notebook (aka laptop): Acer brand
    - Tablet PC
    - PDA (Personal Digital Assistant)

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- Ch 6 page 151 figure 6-2 Tablet PCs
  - Photos of
    - Convertible tablet PC – has a monitor that swivels on the unit
    - Slate tablet PC – monitor directly attached to system unit without an attached keyboard
- Ch 6 page 152 figure 6-3 The digital world. Data and information in digital form can be processed and sent almost anywhere in the world in seconds.
  - photo of bits encircling the globe
    - In order for computer to process data and to efficiently share information over the Internet, it must be in a digital format
    - This is an introduction to Binary coding schemes
- Ch 6 page 152 figure 6-4 Binary codes
  - A table of three common encoding standards including:
    - ASCII: used with microcomputers
    - EBCDIC: IBM based standard for mainframes
    - Unicode: 16 bit scheme for International languages
- Ch 6 page 153 figure 6-5 ASCII and EBCDIC binary coding schemes
  - Table listing characters (A-Z, 0-9) as they would be encoded as ASCII and EBCDIC codes, e.g.
    - A – ASCII 0100 0001 – EBCDIC 1100 0001
    - Z – ASCII 0101 1010 – EBCDIC 1110 1001
    - 0 – ASCII 0011 0000 - EBCDIC 1111 0000
    - 9 – ASCII 0011 1001 – EBCDIC 1111 1001
    - Might be a good opportunity to discuss binary number systems
- Ch 6 page 154 On the Web Explorations
  - Suggestion for students to learn more about one of the manufacturers of system unit components
- Ch 6 page 155 figure 6-6 System board
  - Drawing of a motherboard showing components such as
    - Socket: connection point for CPU chip
    - Carrier package: covering with connections for chip
    - Bus lines: electrical connections
    - Slot: where you would plug in an adapter card
- Ch 6 page 155 figure 6-7 Chip
  - Photo of a silicon chip less than the size of a human finger tip
- Ch 6 page 155 figure 6-8 Chip being mounted onto a carrier package
- Ch 6 page 155 figure 6-9 Bus lines
- Ch 6 page 156 figure 6-10 Microprocessor carrier package and cartridge
  - for the Intel Pentium 4 CPU
- Ch 6 page 157 figure 6-11 Processing speeds
  - Table listing processing times including:
    - Microsecond: millionth of a second – data transfer speeds
    - Nanosecond: billionth of a second – CPU speeds

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- ▪ Picosecond: trillionth of a second – supercomputer speeds
- Ch 6 page 157 On the Web Explorations
  - o Students are encouraged to learn more about a leader in RISC research and development
- Ch 6 page 157 figure 6-12 Popular microprocessors
  - o Table listing some companies that manufacture processor chips, including:
    - ▪ Intel
    - ▪ AMD
    - ▪ Motorola
    - ▪ Sun
- Ch 6 page 157 figure 6-13 Smart card
  - o Photo showing a VISA credit card with a special chip embedded in it
- Ch 6 page 158 figure 6-14 RAM chips mounted on a circuit board
  - o Image showing memory chips which could be inserted onto a motherboard to increase the computer's main memory.
    - ▪ Might want to have students research Kingston memory, a company that specializes on microcomputer memory products
- Ch 6 page 159 figure 6-15 Memory Capacity
  - o Table showing typical capacities including:
    - ▪ Megabyte (MB) – 1 million bytes – typically measure RAM capacity
    - ▪ Gigabyte (GB) – 1 billion bytes – typically measure hard drive capacity
    - ▪ Terabyte (TB) – 1 trillion bytes – typically measure total server capacity
- Ch 6 page 159 figure 6-16 Memory
  - o Table showing common memory types including:
    - ▪ RAM – holds programs and data for active program
    - ▪ ROM – fixed start up instructions
    - ▪ CMOS – flexible start-up instructions (e.g. BIOS)
- Ch 6 page 160 TIPS box for increasing your computer's speed
  - o Uninstall programs you no longer need
  - o Remove unneeded fonts
  - o Empty the Recycle Bin
- Ch 6 page 161 figure 6-17 Expansion cards fit into slots on the system board
  - o Image showing how you could add an expansion card such as a Network Interface Card onto the motherboard
- Ch 6 page 161 figure 6-18 Expansion card
  - o Image of a circuit board with several different ports (looks like an audio card)
- Ch 6 page 161 figure 6-19 Modem card

- o Image of a PC card that would typically be inserted into a laptop or portable computer, in this case for connecting to a network via a telephone line.
- Ch 6 page 164 TIPS box giving suggestions for upgrading your system including:
  - o Select a reputable computer store
  - o Visit the store with your computer
  - o Tag your system
  - o Pay by credit card
- Ch 6 page 164 figure 6-20 Inserting a PC card into a notebook computer
  - o PC cards are also known as PCMCIA cards – Personal Computer Memory Card International Association cards – used to connect to wired or wireless networks, etc.
- Ch 6 page 165 figure 6-21 Bus is a pathway for bits
  - o Close up photo showing bus lines on a circuit board
- Ch 6 page 165 figure 6-22 Ports
  - o Photo showing some common ports (connection points for external devices) on the back of a computer, including:
    - Keyboard and mouse 9 pin serial ports
    - USB ports for various devices
    - 15 pin Video port (male end)
    - Parallel port typically for printers
    - IrDA port – Infrared Data Association port for wireless communication
    - Additional 9 pin male serial port (game port)
- Ch 6 page 166 figure 6-23 Power supply unit
  - o Typically Supplies 200-400 watts to power the computer
  - o Converts AC power from wall to DC power for PC
  - o Includes a fan for cooling
- Ch 6 page 166 figure 6-24 AC adapter
  - o Converts AC power from wall to DC power for PC (typically a laptop/notebook computer)