The Computer System

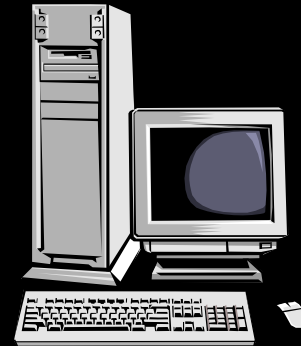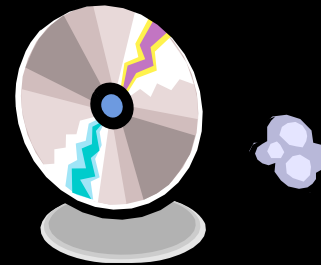## (The Parts Of The Computer)

Mr. Dave Clausen

La Cañada High School

The Computer System Is Comprised Of Two Categories:

◆ Hardware- Parts of the computer you can actually touch. (Monitors, keyboards, mouse, board, chips)

◆ Software - Programs that can be stored electronically.

Computer Software

Computer Software –
A set of instructions or program that tell the computer what to do. Software is often divided into two categories:

Systems Software: Includes the operating system and all the utilities that enable the computer to function. Examples include Windows 2000, XP, Vista, Windows 7, Windows 8, Mac OS X, and Linux.

Applications Software: Includes programs that do specific work for users. For example, word processors, spreadsheets, database, video editors, and music players fall under the category of applications software.

Applications Software Examples

◆ **Word Processing** - is used for typing letters, reports, and other documents. Popular word processing programs include Microsoft Word, Word Perfect, and Pages (Mac).

◆ **Spreadsheets** - are generally used to perform repeated mathematical calculations and to create graphs and charts that visually represent numeric data. Popular spreadsheet programs include Microsoft Excel, Lotus, and Numbers (Mac).

◆ **Databases** - are used to organize and arrange data. Database software can categorize, alphabetize and filter data. Popular spreadsheet programs include Microsoft Access, and FileMaker Pro (Mac).

Let's Look At Hardware:

◆ Four Types Of Computers:

◆ Both of the following use "shared terminals"

– 1. Super Computers and
   Main Frames

– 2. "Mini-Computers"

◆ Both of the following are single user computers

– 3. Workstations (SPARC, CGI)
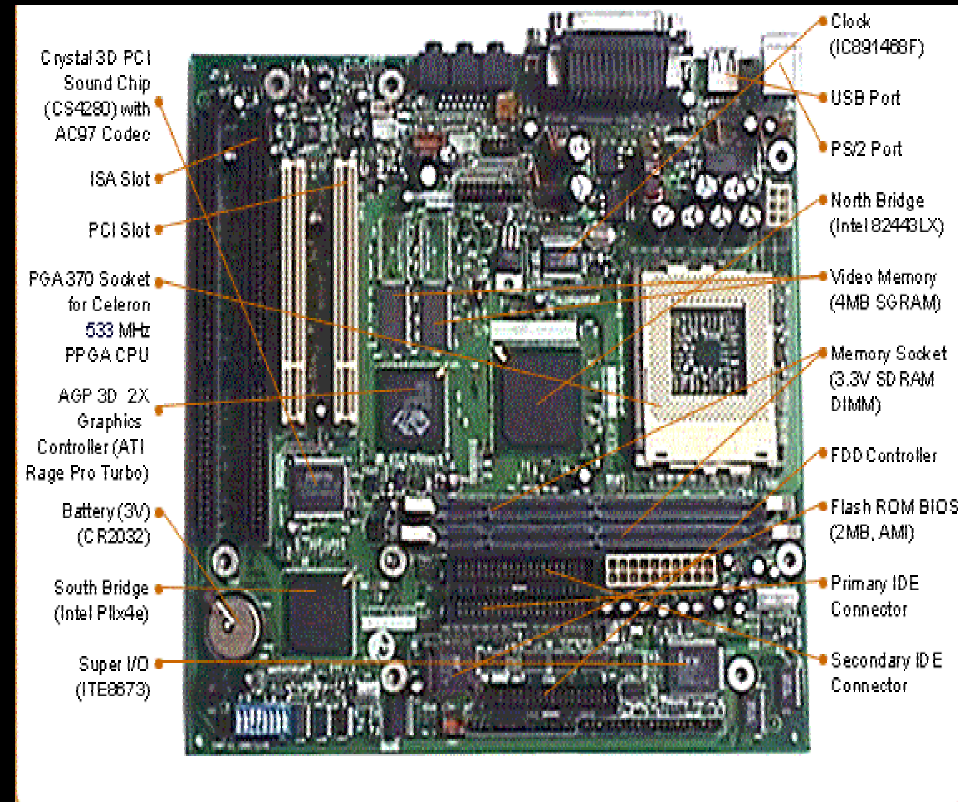
– 4. Micro Computers
   (Personal Computers: PCs)
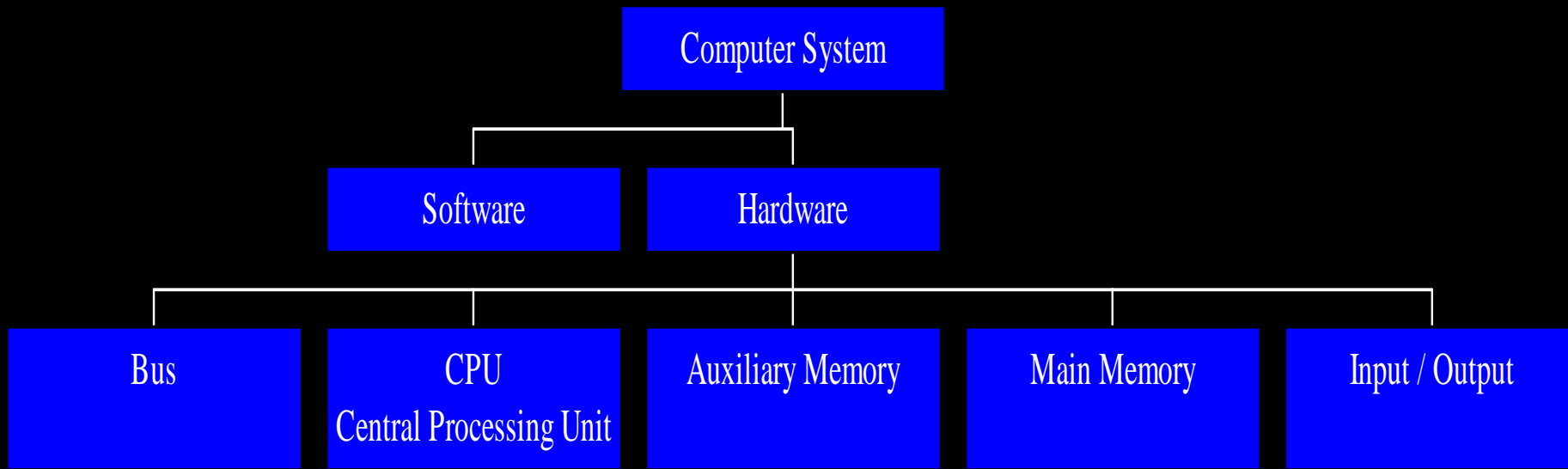
We Will Focus On Micro Computers:
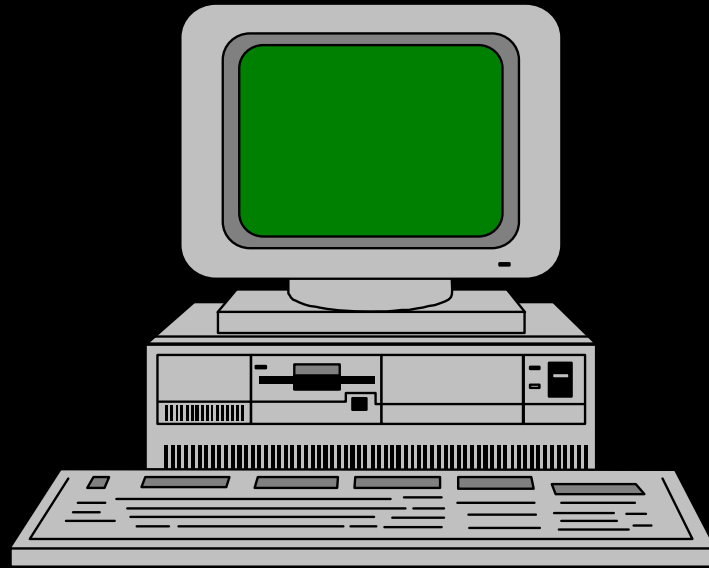
I. The Parts Of A Computer - (Intro)

◆ **A. Bus**

◆ **B. CPU**

◆ **C. Auxiliary Memory**

◆ **D. Main Memory**

◆ **E. Input/Output**

◆ **F. Peripherals**

Crystal 3D PCI Sound Chip (CS4280) with AC97 Codec

ISA Slot

PCI Slot

PGA 370 Socket for Celeron 533 MHz PPGA CPU

AGP 3D 2X Graphics Controller (ATI Rage Pro Turbo)

Battery (3V) (CR2032)

South Bridge (Intel PIIx4e)

Super I/O (ITE8673)

Clock (IC891468F)

USB Port

PS/2 Port

North Bridge (Intel 82443LX)

Video Memory (4MB SGRAM)

Memory Socket (3.3V SDRAM DIMM)

FDD Controller

Flash ROM BIOS (2MB, AMI)

Primary IDE Connector

Secondary IDE Connector

Parts of The Computer

Organizational Parts of The Computer

```
                        ┌──────────────────┐
                        │ Computer System  │
                        └──────────────────┘
                ┌────────────────┴────────────────┐
        ┌───────────────┐              ┌───────────────┐
        │   Software    │              │   Hardware    │
        └───────────────┘              └───────────────┘
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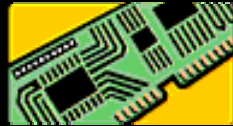| Bus	CPU Central Processing Unit	Auxiliary Memory	Main Memory	Input / Output

A. Bus:
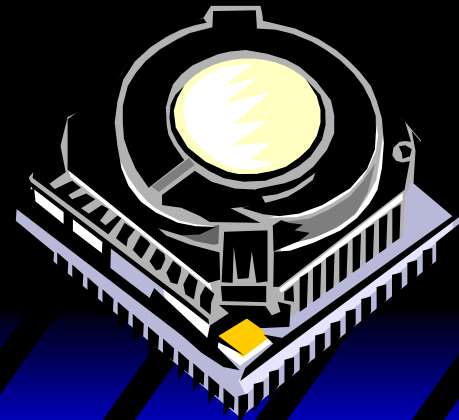
◆ Connects the different parts of a computer ("Wires")

◆ All information going from
one component to another
goes through the bus.

B. CPU :

◆ Carries Out The Instruction Of The Program.

❖ If the instruction requires the services of some other device (I/O) the CPU sends the control codes to do the job requested.

C. Main Memory :

– Data, programs, stored in main memory.
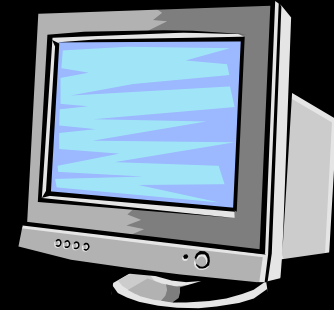
– (analogous to a Blackboard)

D. Auxiliary Memory :

◆ Used For Long Term Storage Of Data Files, Or Programs

– (Analogous to a Filing Cabinet)

F. Input/output Devices :

◆ Translates information between machines and people

– Convert data between binary codes and forms useful for humans (pictures, sounds, text)

❖ 'A' is represented by the number 65 or 01000001 in binary code.

G. Peripherals :

◆ Input Devices

◆ Output Devices

◆ Auxiliary Memory

The Bus

◆ Connects computers components to one another and provides the means for data to be transmitted between components.

◆ The bus has progressed from physical wires to etched "wires" on a circuit board.

◆ The bus has also grown from 8 bits to 16 bits to 32 bits to 64 bits.
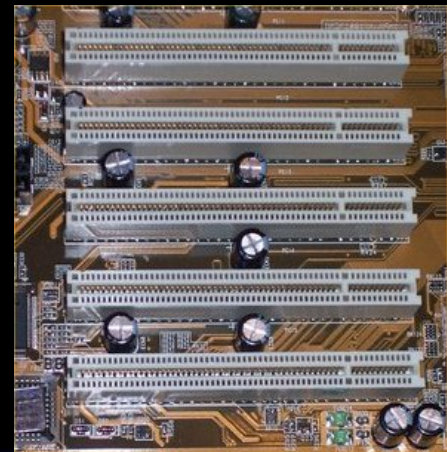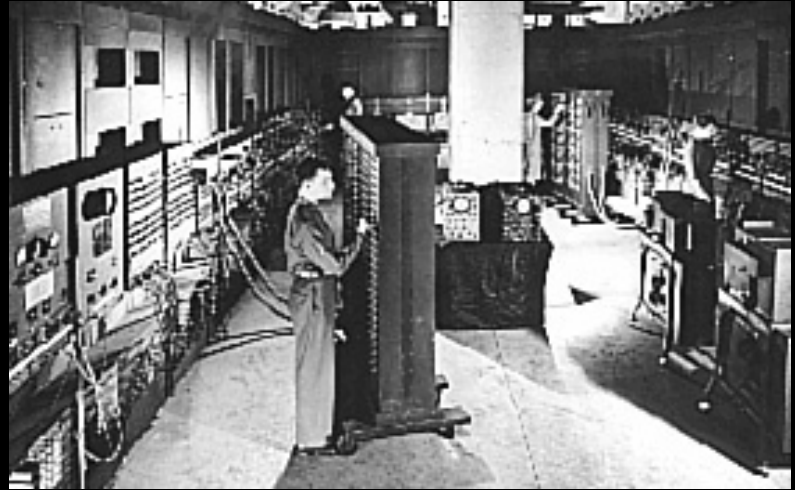
II. CPU : Central Processing Unit

◆ The essential part of a computer because it executes the instructions in the program

◆ The CPU also performs the calculations.

◆ (the most complex part of computers.)
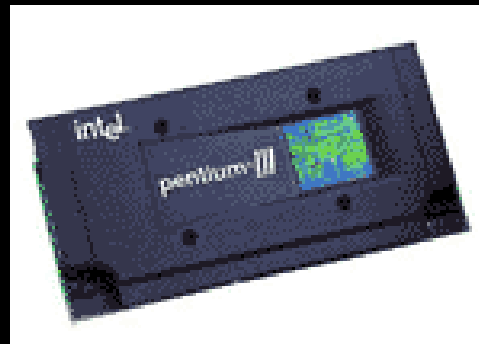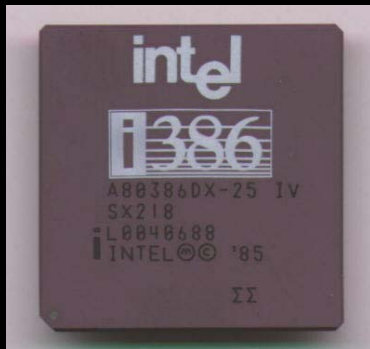
Organization Of The CPU

◆ A. The Arithmetic - Logic Unit (ALU)

   ❖ 1. Arithmetical Operations:

   ❖   add, subtract, multiply, and divide

   ❖ 2. Comparisons -

      – a) To See If 2 Alphabetic Characters Are The Same (Or
        To Sort Alpha)

      – b) Numbers <, =, > (Trichotomy Property)

      – c) Decision Making Capability....

   ❖ 3. Logical Operations

      – AND, OR, NOT   True, False

Organization of the CPU Cont.

◆ B. The Control Unit (CU)

– Fetches the instructions one by one from main memory.

– Decodes each instruction, and sends the control signals to other units (ALU or peripherals).

– Works on a cycle of fetch & execute

Organization of the CPU Cont.

◆ C. Math Coprocessor

- Sometimes a math coprocessor is used to do sophisticated mathematical calculations.

- (i.e.. Trig. functions, statistics, some spreadsheets, 3-D graphics manipulations etc.)
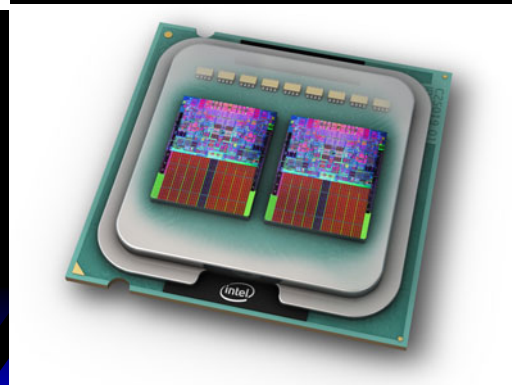
◆ Starting with the Pentium processors, the Math coprocessor has been built in to the CPU.

CPU History

The CPU has progressed from 8 bits to 16 bits to 32 bits to 64 bits, which is why the bus system has followed suit.

History of Intel CPU's

- 8088
- 80286
- 80386
- 80486
- Pentium
- Pentium II
- Pentium III
- Pentium 4
- Dual Core
- Core 2 Quad
- i3, i5, i7
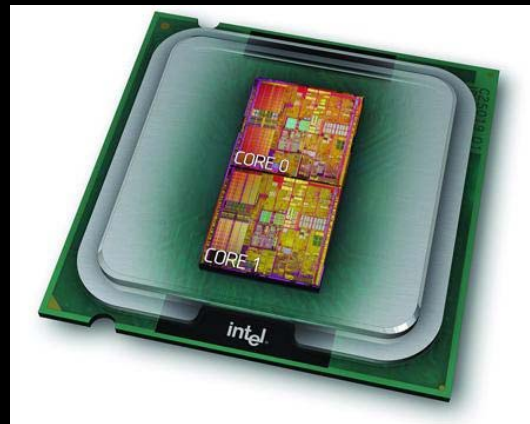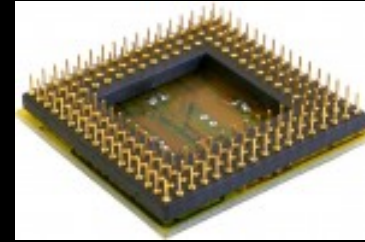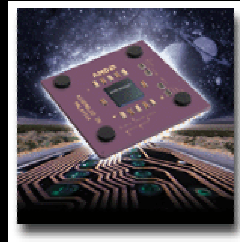
History of Motorola CPU's (Macs)

- 68000
- 68020
- 68030
- 68040
- PowerPC's
  - 603
  - 604
  - 615

- G3
- G4
- G5
- Dual Core Intel Chip
- Core 2 Quad
- Quad Core (4, 6, 8, 12 cores)
- i3, i5, i7
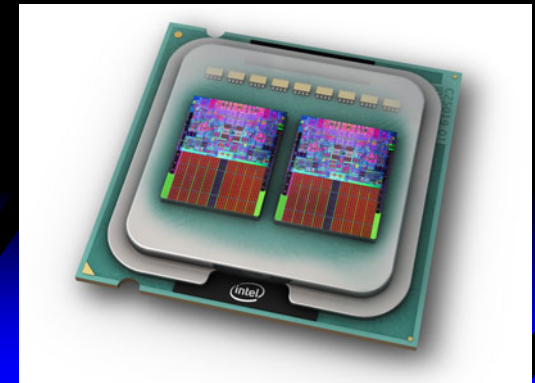
CPU Terminology

◆ In early CPU's the speed was measured in MHz (Mega Hertz) as the first CPU's operated at 1.7 MHz (millions of operations).

◆ Currently CPU's have progressed to GHz (Giga Hertz) and operate at 2 to 4 GHz (billions of operations).

III. Computer Memory :

◆ Part Of The Computer That Stores Information

◆ Main Memory

– (analogous to a Blackboard)

◆ Auxiliary Memory

– (analogous to a Filing Cabinet)

Memory	
Main Memory	Auxiliary Memory
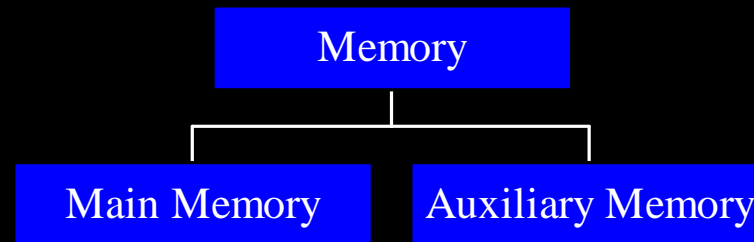
A. Main Memory

◆ Main memory is divided into a large number of individual memory locations each, can hold a certain amount of data. each location has an address, which the CPU uses to designate which location to store data in or retrieve data from. (Can access info in billionths of a second)
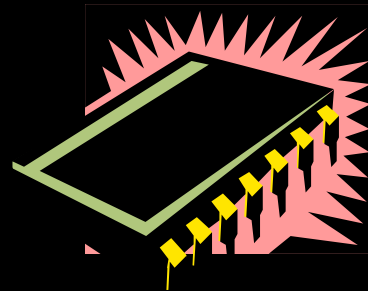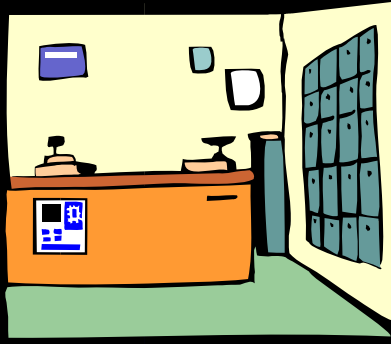
Two Categories Of Main Memory:

◆ 1. RAM (RANDOM ACCESS MEMORY)
  – Read-write Memory
  – Contents Are Volatile
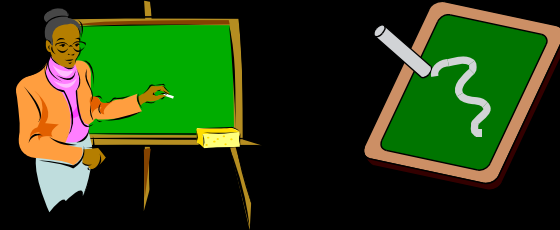
◆ 2. ROM (READ ONLY MEMORY)
  – Read Only Memory - Permanent Storage,
  – Can't Be Changed, Installed In Computer

```
          Main Memory
         /          \
      RAM            ROM
```
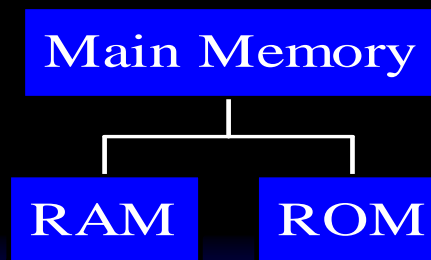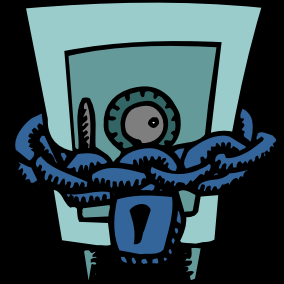
RAM Terminology

◆ In the first computers, RAM was measured in Kilobytes (Kb thousands of bytes) and typically came in 32Kb or 64Kb

◆ Next, RAM was measured in Megabytes (Mb millions of bytes)

◆ In today's computers, RAM is measured in Gigabytes (Gb billions of bytes) and typically come with anywhere from 1Gb to 128Gb.

B. Auxiliary Memory

◆ Used For Long Term Storage
  – Of Data, Files, Or Programs (analogous to a Filing Cabinet)

◆ Frequently uses removable media stored separately from the computer

250MB USB-Powered
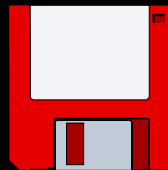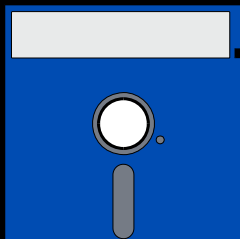
Auxiliary Memory Terminology

◆ Early Auxiliary Memory was measured in Kilobytes (Kb thousands of bytes)

◆ Then was measured in Megabytes (Mb millions of bytes)

◆ Can be measured in Gigabytes (Gb billions of bytes – ie flash drives)

◆ But it is now usually measured in Terabytes (Tb trillions of bytes – usually 1-4 Tb for hard drives)

Units of Memory Storage Capacities

Bit	Smallest unit of information. Can hold one of two values: 0 or 1 (**Binary digit**)
Byte	1 character of information (8 bits of information or **Binary Term**)
Kilobytes	1,024 bytes or 2^{10} (~ thousand)
Megabyte	1,048,576 bytes or 2^{20} (~ million)
Gigabyte	1,073,741,824 bytes or 2^{30} (~ billion)
Terabyte	1,099,511,627,776 bytes or 2^{40} (~ trillion)

1,125,899,906,842,624 Petabyte or 2^50 (~Quadrillion)

Examples of Auxiliary Memory

- ◆ 1. Magnetic Tape
    - ❖ Draw Back - Sequential - Access
        - – Old Cassette Tape
        - – "Reel to Reel" tapes for Main Frame computers.
        - – backup media DAT (digital audio tape) (cassette cartridges-can back up 40Mb originally and now 40 Gb)
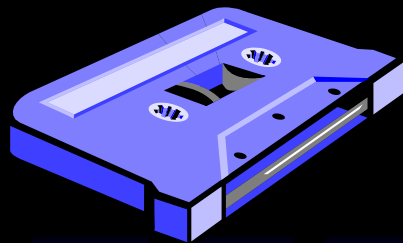
Examples of Auxiliary Memory 2

◆ 2. Magnetic Disks

❖ Data Is Recorded As Circular Patterns of Magnetization Rather Than in Grooves (or Spirals).

❖ A. Floppy Disks, Diskettes (170Kb – 1.44Mb)
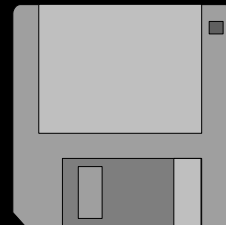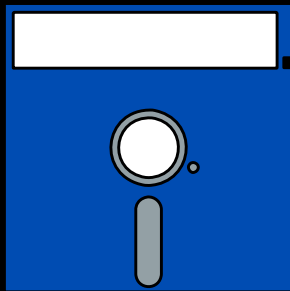
Examples of Auxiliary Memory 3

❖ B. Hard Disks (20Mb to Several Hundred Gigabytes to single digit Terabytes.)

❖ C. Solid State Drives

– SSDs use microchips, and contain no moving parts.

– 32 Gb – 250 Gb now, but commercial used have 1 Tb

– most SSDs use flash memory, which retains memory even without power.

– As of 2010, SSDs are still more expensive per gigabyte than hard drives. Whereas hard drives are around US$0.10 per gigabyte for 3.5", or US$0.20 for 2.5", a typical flash drive is US$2 per gigabyte

Examples of Auxiliary Memory 4

◆ 3. Removable Media

❖ a) Old - SYQUEST hard drives-removable cartridge (40-200 Mb)

❖ b) Old - FLOPTICAL or OPTICAL drives (100-200 Mb)

❖ c) CDR Recordable CD-ROM (700Mb)

8 x 4 x 32 Firewire

❖ d) ZIP Drives (100Mb or 250 Mb)

100MB USB

250MB USB-Powered

Examples of Auxiliary Memory 5

◆ 3. Removable Media continued

❖ e) Jaz Drive (1 or 2 Gb)

2GB External

❖ f) DVD-RAM, DVD-R, DVD +R, DVD-RW (4.7 Gb – 9Gb)

❖ g) Iomega Peerless (10 – 20 Gb)

Examples of Auxiliary Memory 6

◆ 4. Portable External Auxiliary Memory

– a) Portable Hard Drives

❖ 5.25", 3.5", 2.5" or 1"

❖ Capacities from 1Gb to 1-4 Tb

– b) USB Drives

❖ 32 Mb to 128 Gb

IV. Input / Output Devices

◆ Interfaces Between A Computer & World Outside

Input Devices Past And Present

◆ A. Old - Card Readers & Card Punches

– senses holes in each card & transmits the info. to the computer.

– (punched cards, Hollerith cards) 80 columns

– card punch (key punches) operate using a type-writer like keyboard.

Input Devices 2

- B. Old - KEY-TO-TAPE   KEY-TO-DISK
  - accept input from keyboard & store on tape or flexible disk.
- C. Optical Character Readers (OCR) Flatbed Or Handheld Scanners
  - read input from documents: treat as picture or text

- D. Keyboard enter alpha characters into computer

Input Devices 3

– E. Mouse: move graphics, select menu items, open programs by clicking on them

– F. Microphone: can talk to your computer to give it instructions
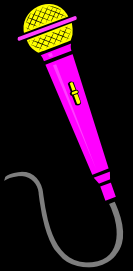
– G. Touch screen monitor: touch part of screen that correlates to menu choice
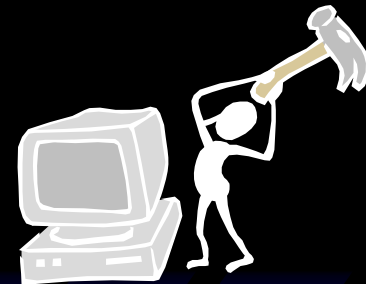
Input Devices 4

– H. Joystick to play games or draw

– I. MODEM to enter info from another computer
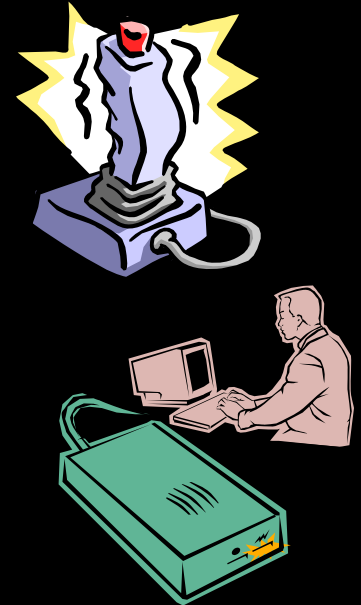
– J. Graphics Tablet to draw, paint, or write in the computer

Output Devices:

- – J. Printers
    - ❖ Two Categories: Impact And Non-impact
        - – Impact
            - – 1. Old - Dot - Matrix
        - – Nonimpact
            - – 3. Ink Jet
            - – 4. Old - Thermal
            - – 5. Laser
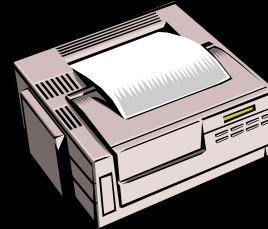
Output Devices 2

– K. Computer Output Microfilm (for library archival use)

– L. Typewriter Terminals - (typewriter/printer)
   ❖ (Old technology unless paired with main frame computer)

Output Devices 3

– M. Monitors (Video Display Terminals (VDT) keyboard/TV; CRT cathode ray tube; LCD-passive or active matrix screens)

  ❖ 1) Old - monochrome

  ❖ 2) color (VGA, Super VGA, XGA, etc.)

Output Devices 4

– N. Plotters

  ❖ drawings,blue prints, graphs, maps, weather maps (isobar charts), seismograph, lie detectors

– O. Speech Synthesizers

  ❖ grocery stores, speakers built into computer.

– P. Speakers

  ❖ Music output
  ❖ Text to speech

Input / Output Devices

- Q. Video
  ([Bad Day at the Office 1](#))
  ([Bad Day at the Office 2](#))
    - ❖ Digital Video
    - ❖ Video Editing

- R. MODEMS to send info to another computer.
    - ❖ Dial Up
    - ❖ DSL
    - ❖ Cable
    - ❖ FIOS
- S. Network (Ethernet) Cards

Input / Output Devices

◆ T. Music / MIDI recording

   – Inputs to record and edit music

      ❖ USB and FireWire

   – Outputs to mix and listen to music

Computer Terms 1

A **bit** is short for **bi**nary digi**t**, the smallest unit of information on a machine. A single bit can hold only one of two values: 0 or 1. More meaningful information is obtained by combining consecutive bits into larger units. For example, a byte is composed of 8 consecutive bits (**b**inary **te**rm).

Computer Terms 2

A **byte** is an abbreviation for binary term, a unit of storage capable of holding a single character. On almost all modern computers, a byte is equal to 8 bits. Large amounts of memory are indicated in terms of kilobytes (1,024 bytes), megabytes (1,048,576 bytes), gigabytes (1,073,741,824 bytes) and terabytes (1,099,511,627,776 bytes). A floppy disk that can hold 1.44 megabytes, for example, is capable of storing approximately 1.4 million characters, or about 3,000 pages of text.

Computer Terms 3

ASCII is an acronym for the American Standard Code for Information Interchange. ASCII is a code for representing English characters as numbers, with each letter assigned a number from 0 to 127. For example, the ASCII code for uppercase M is 77. Most computers use ASCII codes to represent text, which makes it possible to transfer data from one computer to another.

ASCII Code

0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT
1	LF	VT	FF	CR	SO	SI	DLE	DC1	DC2	DC3
2	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS
3	RS	US	SP	!	"	#	$	%	&	`
4	(	)	*	+	,	-	.	/	0	1
5	2	3	4	5	6	7	8	9	:	;
6	<	=	>	?	@	A	B	C	D	E
7	F	G	H	I	J	K	L	M	N	O
8	P	Q	R	S	T	U	V	W	X	Y
9	Z	[	\	]	^	_	'	a	b	c
10	d	e	f	g	h	i	j	k	l	m
11	n	o	p	q	r	s	t	u	v	w
12	x	y	z	{	|	}	~	DEL		

Full ASCII Code Chart

Dec	Hx	Oct	Char		Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL	(null)	32	20	040	 	Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH	(start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX	(start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX	(end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT	(end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ	(enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK	(acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL	(bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS	(backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB	(horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF	(NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT	(vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF	(NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR	(carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO	(shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI	(shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE	(data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1	(device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2	(device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3	(device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4	(device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK	(negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN	(synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB	(end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN	(cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM	(end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB	(substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC	(escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS	(file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174	|		
29	1D	035	GS	(group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS	(record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US	(unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

Computer Terms 4

Unicode "is a character encoding standard developed by the Unicode Consortium. The aim of the standard is to provide universal way of encoding characters of any language, regardless of the computer system, or platform, being used. The core of Unicode, known as the Basic Multilingual Plane, contains space for over 65,536 characters."

http://www.etext.leeds.ac.uk/cocoon/glossary.xml

(ASCII is a subset of Unicode)
http://www.unicode.org/charts/

Computer Terms 5

Modem is an acronym for modulator-demodulator. A **modem** is a device or program that enables a computer to transmit data over telephone lines. Computer information is stored digitally, whereas information transmitted over telephone lines is transmitted in the form of analog waves. A modem converts between these two forms.

Computer Terms 6

DSL refers collectively to all types of digital subscriber lines generally used to connect to the internet. This technology uses the existing copper pair wiring that exists in almost every home and office. DSL offers much higher speeds than traditional modem internet connections but requires short telephone line runs to a central telephone office (usually less than 20,000 feet). Another advantage of DSL is that you can be connected to the internet and use the same phone line to make and receive phone calls at the same time.

Computer Terms 7

Booting-up a computer refers to loading the first piece of software that starts a computer. Because the operating system is essential for running all other programs, it is usually the first piece of software loaded during the boot process. Boot is short for bootstrap, which in olden days was a strap attached to the top of your boot that you could pull to help get your boot on. Short for bootstrap, the starting-up of a computer, which involves loading the operating system and other basic software. A **cold boot** is when you turn the computer on from an off position. A **warm boot** (**reboot**) is when you reset a computer that is already on without using the power switch, usually by depressing a combination of predetermined keys simultaneously (Control, Alt, & Delete for most PC's).

Computer Terms 8

A **virus** is a computer program or a piece of code that secretly attaches itself to other programs and is activated when the host program is executed. A virus can replicate itself and be passes to other computers. All computer viruses are manmade. Viruses usually perform some unwanted action, ranging from nuisance to destruction. A simple virus that can make a copy of itself over and over again is relatively easy to produce. Even such a simple virus is dangerous because it will quickly use all available memory and bring the system to a halt. Some viruses, for example, simply display a message at predetermined times. Other viruses attempt to reformat your hard disk and destroy all your data. Since 1987, when a virus infected ARPANET, a large network used by the Defense Department and many universities, many antivirus programs have become available.