Unit - II

Computer Concepts and C Programming (06CCP13)

Unit II

Unit Division

- Unit-II (6 Hours)
  - Processing Data
  - Storing Data

Topics

- Transforming Data into Information
- How computers represent data
- How computers process data
- Factors affecting processing speed
- Microcomputer processors
- Extending the processor’s power to other devices

Transforming Data into Information

In order to use the computer it is necessary to understand how the computer works internally, what will happen when an input is given to the machine can it understand the way we present the data or it is going to convert it into some other format

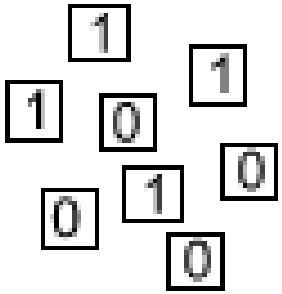
Transforming Data into Information

A general-purpose machine that processes data according to a set of instructions that are stored internally either temporarily or permanently. The instructions that tell it what to do are called "software." A set of instructions that perform a particular task is called a "program" or "software program."

How computers represent data

Even though the processor is the brain of the computer, it is actually very limited in what it understands. The processor only recognizes two digits: the "0" and the "1". (The two digit language is known as binary.) All information is stored as 0's and 1's. The 0's and 1's are referred to as bits. (The smallest unit of information on a computer.) A byte is a combination of 8 bits.

Bits and Bytes



8 individual bits

8 bits come together to make a byte

How computers represent data

Multiple bytes can be combined to form even more complex units of information. Examples of these units are the kilobyte (KB), the megabyte (MB,) and the gigabyte(GB). A kilobyte is 2 to the 10th power bytes or 1,024 bytes, a megabyte is 2 to the 20th power bytes or 1,048,576 bytes, and the gigabyte is 2 to the 30th power bytes or 1,073,741,824 bytes.

How computers represent data

When computers refer to memory or storage they refer to terms using the following forms of measurement.

- 8 bits = 1 byte
- 1024 bytes = 1 Kilobyte (KB)
- 1024 Kilobytes = 1 Megabyte (MB)
- 1024 Megabytes = 1 Gigabyte (GB)

hard drives are usually two or more gigabytes of memory and a floppy disk has 1.44 megabytes of memory

How computers represent data

- **Binary Number system:** Computer programs operate on data and ultimately enable humans to derive meaning from these representations. The Binary number system is the simplest of all number system

$2^7=128$	$2^6=64$	$2^5=32$	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
1	1	1	1	1	0	1	1

How computers represent data

EBCDIC is eight bits, or one *byte*, wide. Each byte consists of two *nibbles*, each four bits wide. The first four bits define the class of character, while the second nibble defines the specific character inside that class. For example, setting the first nibble to all-ones, *1111*, defines the character as a number, and the second nibble defines which number is encoded

How computers represent data

- **ASCII:** ASCII stands for the American Standard Code for Information Interchange. As a standard, ASCII was first adopted in 1963 and quickly became widely used throughout the computer world

ASCII table

ASCII table

Back

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

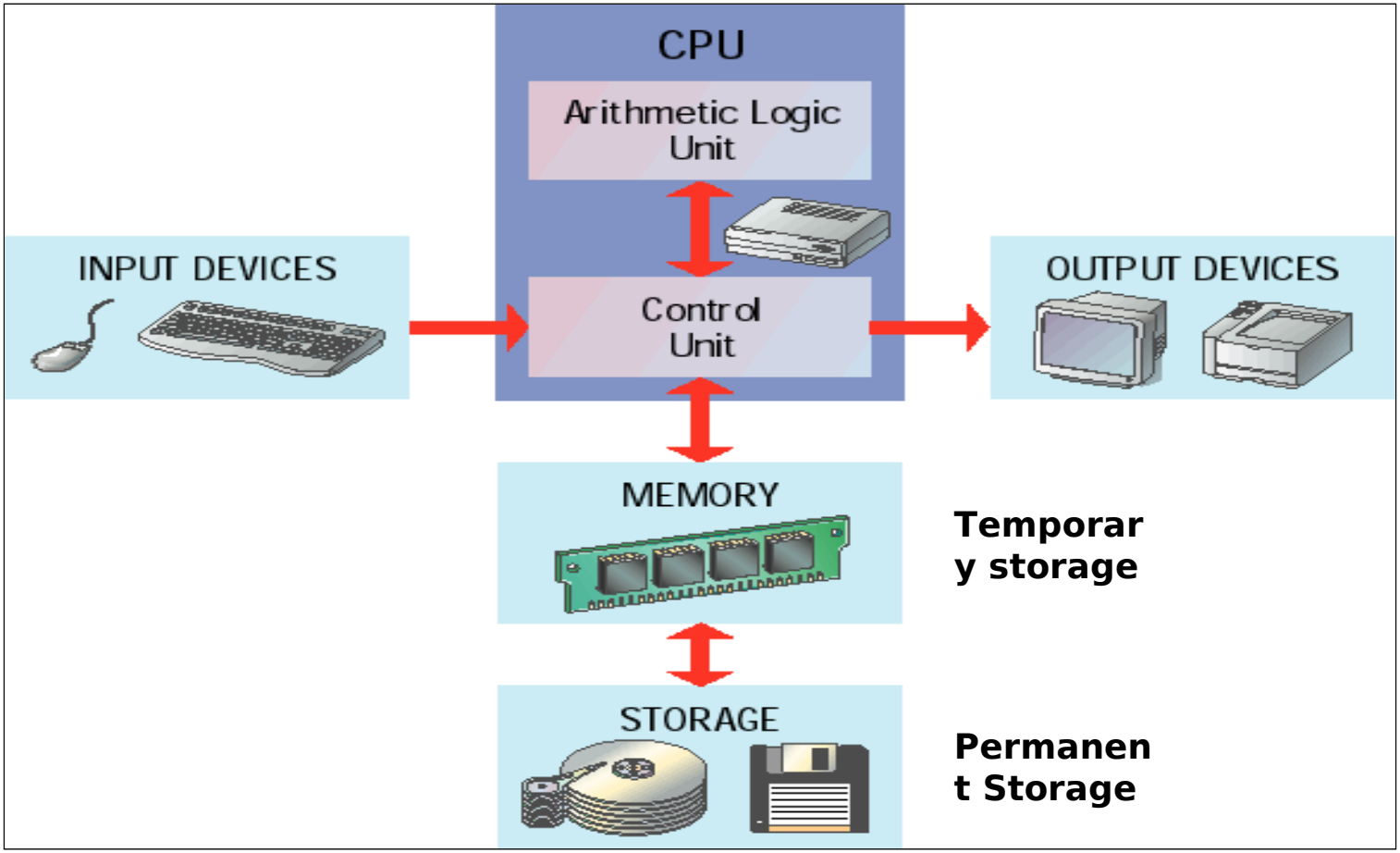
How computers represent data

- **Unicode:**

  Unicode provides a unique number for every character, no matter what the platform, no matter what the program, no matter what the language.

- Fundamentally, computers just deal with numbers. They store letters and other characters by assigning a number for each one. Before Unicode was invented, there were hundreds of different encoding systems for assigning these numbers

How computers process data



How computers process data

Procedure of System Booting

- The power is made on, then the system software tells the CPU to start up certain programs and to turn on some hardware devices so that they are ready for more input from you. This whole process is called **booting** up

How computers process data

- The next step happens when you choose a program you want to use. You click on the icon or enter a command to start the program.
- The CPU's instructions for carrying out commands are built into the control unit. The instructions, or instruction set, list all the operations that the CPU can perform. This is a key point. At this stage DATA is converted into INFORMATION. e.g. a thousand surveys are converted into a graph that actually means something to a person.

How computers process data

- The CPU and memory are attached to the motherboard, which connects all the computer's devices together. The ALU is connected to small memory areas -- called registers -- that hold data and instructions while they are processed.
- Random-access memory (RAM) is volatile (temporary). Programs and data can be written to and erased from RAM as needed.
- Read-only memory (ROM) is nonvolatile (permanent). It holds instructions that run the computer when it is first turned on.
- The CPU accesses each location in memory by using a unique number, called a memory address.

How computers process data

Machine cycles

- Each time the CPU executes an instruction, it takes a series of steps. The completed series of steps is called a machine cycle. A machine cycle itself can be broken down into two smaller cycles the instruction cycle and the instruction cycle. At the beginning of the machine cycle the CPU takes two steps
  - fetching Before the CPU can execute an instruction, the control unit must ret rive a command or data from the computer's memory.

How computers process data

- Decoding Before a command can be executed, the control unit must break down the command into instructions that correspond to those in the CPU instruction set
- executing When the command is executed, the CPU carries out the instructions in order by converting them into microcodes.
- storing The CPU may be required to store the results of an instruction in memory

Factors affecting processing speed

- How registers affect speed

The size of the registers is sometimes called the word size which indicates the amount of data with which the computer can work at any given time. The bigger the word size, the more quickly the computer can process a set of data. “32 – bit processors,” or ”64 – bit processors,” or even “64 – bit computers.” are some examples of terminology which refers to the size of the register in the processor.

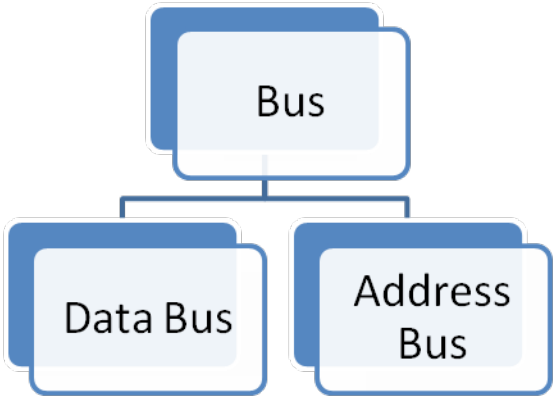
Factors affecting processing speed

- Memory and computing power

The amount of RAM in a computer can have a profound effect on the computer's power. It means more RAM in computer can use bigger, more powerful programs, and those programs can access bigger data files. And more RAM also can make the computer run faster. It comes from the CPU can keep more of the active program and data in memory, rather than in storage

Factors affecting processing speed

- The bus
  The bus refers to the paths between the components of a computer. The data bus and the address bus are two main buses in a computer which are located on the motherboard.



Factors affecting processing speed

- The data bus

It is an electrical path that connects the CPU, memory, and the other hardware devices on the motherboard. The number of wires in the bus affects the speed at which data can travel between hardware components. Each wire can transfer one bit at a time. If it is eight – wire bus, it can move eight bits at a time or a full byte. Thus, the width of the data bus determines how many bits at a time can be transmitted between the CPU and other devices.

Factors affecting processing speed

- The address bus

The second bus that is found in every microcomputer is the address bus. It is a set of wires similar to the data bus that connects the CPU and RAM and carries the memory addresses. The reason of the address bus is important is that the number of wires in it determines the maximum number of memory addresses. For instance, if the address bus could carry only eight bits at a time, the CPU could address only 256 bytes of RAM (28 bytes)

Factors affecting processing speed

- **Cache Memory**

  Cache memory is similar to RAM, except that it is extremely fast compared to normal memory, and it is used in a different way.

  It helps to reduce the time – consuming operation of CPU which is moving data back and forth to RAM.

  It speeds up processing by storing frequently used data or instructions in its high – speed memory

Factors affecting processing speed

Whenever the CPU requests information from RAM, the cache controller intercepts the request and searches its own memory for the requested information. If the information is not here, the CPU retrieves the required data from the RAM memory and also sends a copy back to the cache. The next time the CPU needs the same information, the cache finds that information, and quickly sends it to the CPU, leaving RAM out of the loop

Factors affecting processing speed

- **Passing math operations to the math coprocessor**

A math coprocessor is a chip that is specially designed to handle complicated mathematical operations. Newer CPUs have math coprocessors built in. Math coprocessors support the extreme number of calculations involved in generating computer graphics and video imaging. It holds to be generalist.

Factors affecting processing speed

- **Microcomputer processors**

The microcomputer came after the minicomputer, most notably replacing the many distinct components that made up the minicomputer's CPU with a single integrated microprocessor chip.

The early microcomputers were primitive, the earliest models shipping with as little as 256 bytes of RAM, and no input / output other than lights and switches.

Factors affecting processing speed

However, as microprocessor design advanced rapidly and memory became less expensive from the early 1970s onwards, microcomputers in turn grew faster and cheaper.

The increasing availability and power of such computers attracted the attention of more software developers. As time went on and the industry matured, the market standardized around IBM PC clones running MS-DOS (and later Windows).

Factors affecting processing speed

- The circuitry design of a CPU determines its basic speed, but several additional factors can make chips already designed for speed work even faster. For example CPU's registers, the memory, the cache memory, data bus, and math coprocessor affect a computer's speed.