SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME :19IT301 COMPUTER ORGANIZATION AND ARCHITECTURE

II YEAR /III SEMESTER

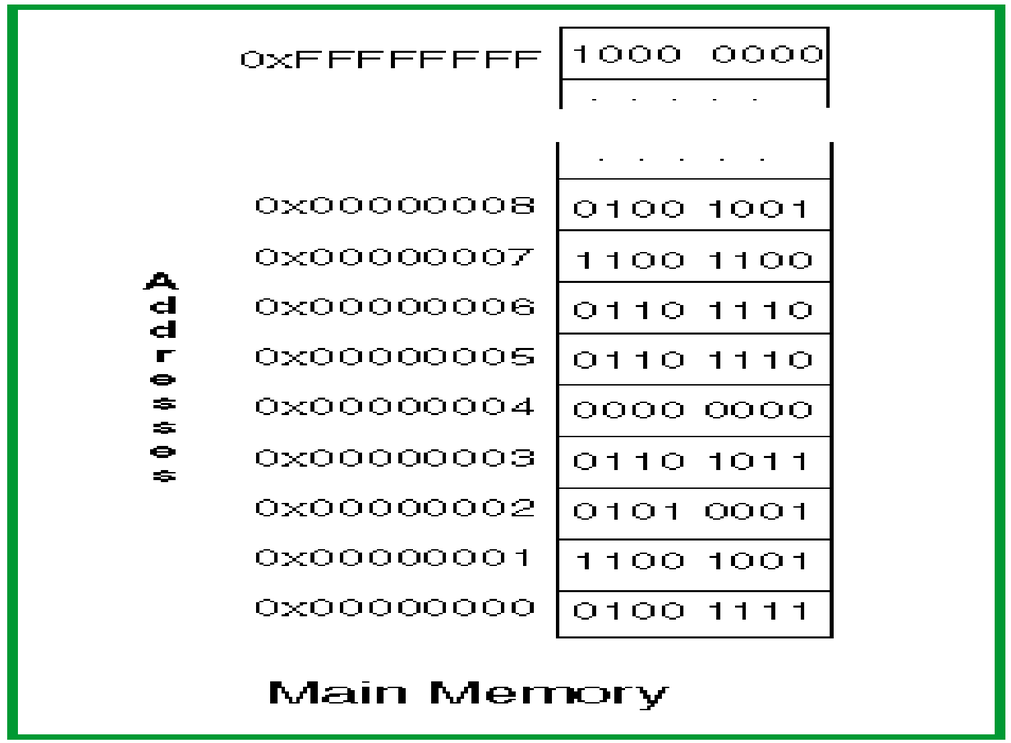
Unit 1- **BASIC STRUCTURE OF COMPUTERS**

Topic 5 : Memory locations and addresses

Topic6 : Memory operations

Memory locations and addresses

- ✓Memory locations- To store data
- ✓Addresses- To identify data
- ✓Data is usually accessed in *n*-bit groups.
- ✓*n* is called word length



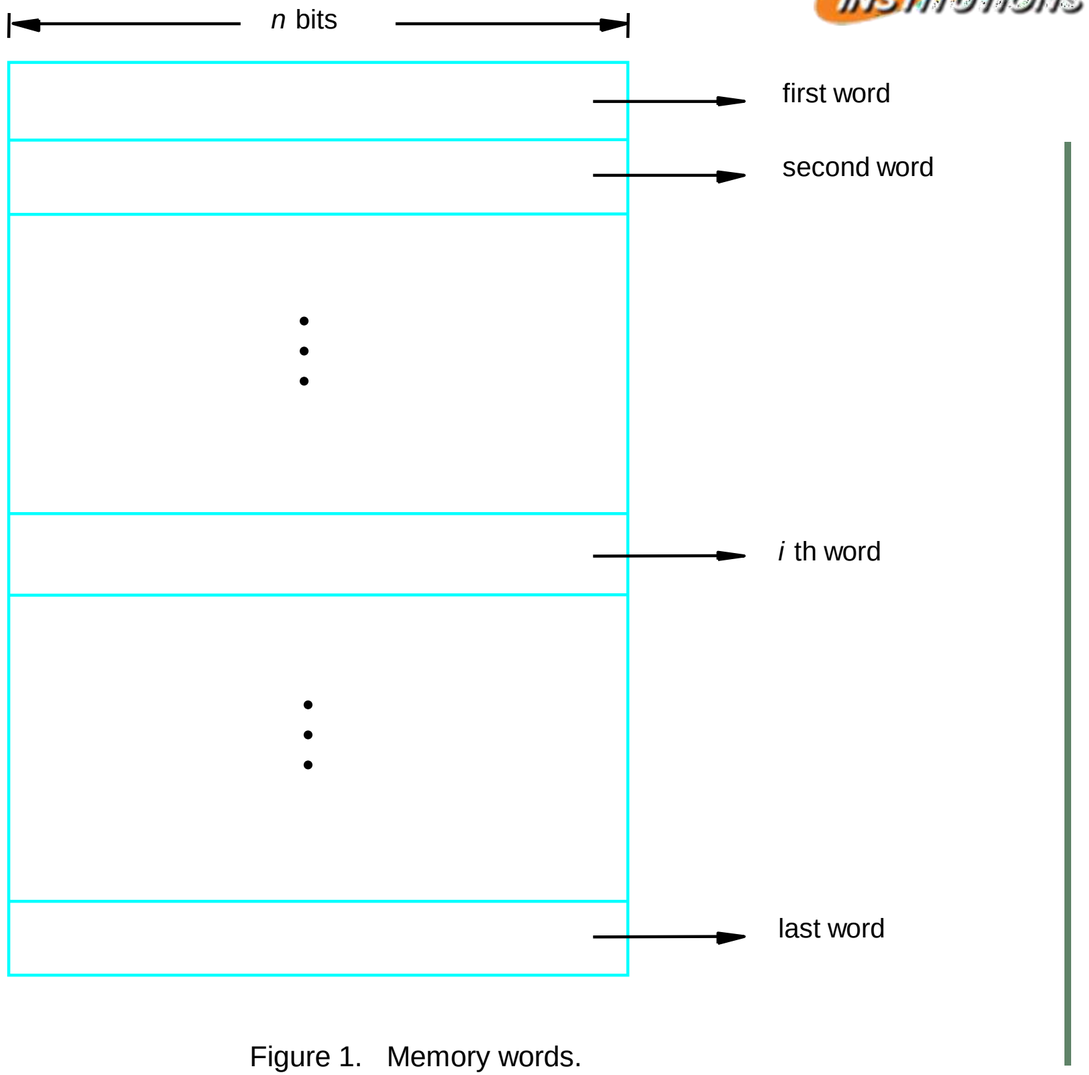
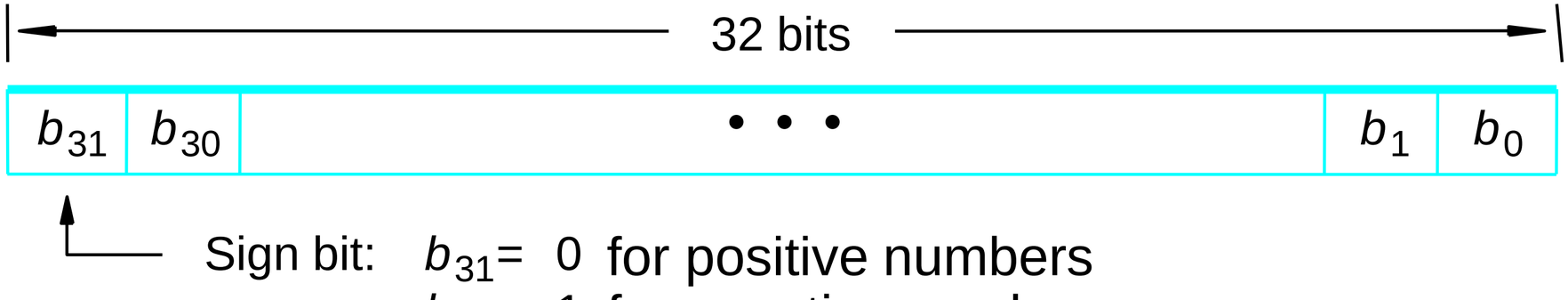


Figure 1. Memory words.

Memory Locations and Addresses,

32-bit word length example



(a) A signed integer

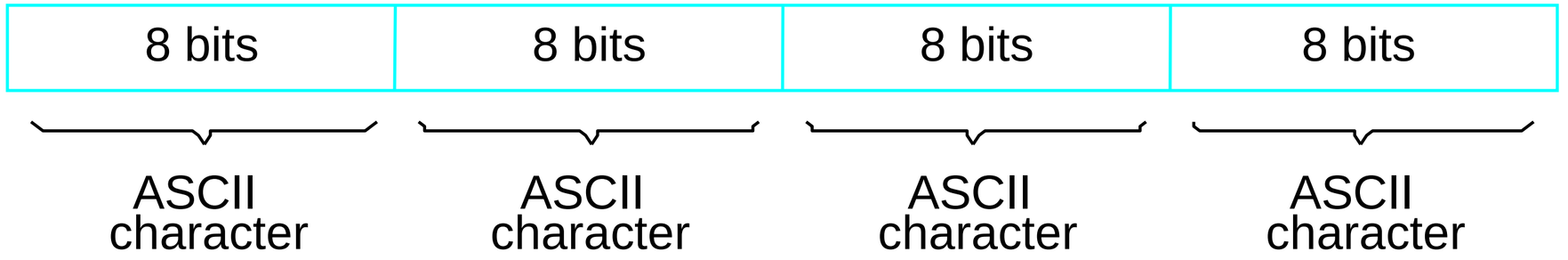


Fig 2 (b) Four characters

Memory locations and addresses

ASCII - Binary Character Table

Letter	ASCII Code	Binary	Letter	ASCII Code	Binary
a	097	01100001	A	065	01000001
b	098	01100010	B	066	01000010
c	099	01100011	C	067	01000011
d	100	01100100	D	068	01000100
e	101	01100101	E	069	01000101
f	102	01100110	F	070	01000110
g	103	01100111	G	071	01000111
h	104	01101000	H	072	01001000
i	105	01101001	I	073	01001001
j	106	01101010	J	074	01001010
k	107	01101011	K	075	01001011
l	108	01101100	L	076	01001100
m	109	01101101	M	077	01001101
n	110	01101110	N	078	01001110
o	111	01101111	O	079	01001111
p	112	01110000	P	080	01010000
q	113	01110001	Q	081	01010001
r	114	01110010	R	082	01010010
s	115	01110011	S	083	01010011
t	116	01110100	T	084	01010100
u	117	01110101	U	085	01010101
v	118	01110110	V	086	01010110
w	119	01110111	W	087	01010111
x	120	01111000	X	088	01011000
y	121	01111001	Y	089	01011001
z	122	01111010	Z	090	01011010

Memory locations and addresses

- ✓To retrieve information from memory, either for one word or one byte (8-bit), addresses for each location are needed.
- ✓A *k*-bit address memory has 2^k memory locations, namely 0 – 2^k-1, called memory space.
- ✓3 bit address bus 2^3= 8 memory locations
- ✓24-bit memory: 2^{24} = 16,777,216 = 16M (1M=2^{20})
- ✓32-bit memory: 2^{32} = 4G (1G=2^{30})
- ✓32 bit word Ex: 28125823
- ✓1K(kilo)=2^{10}
- ✓1T(tera)=2^{40}

Address	Memory locations
000	10010011
001	10010111
010	11010011
011	10110011
100	10000011
101	11010011
110	10010001
111	10110010

28	12	58	23

Memory locations and addresses

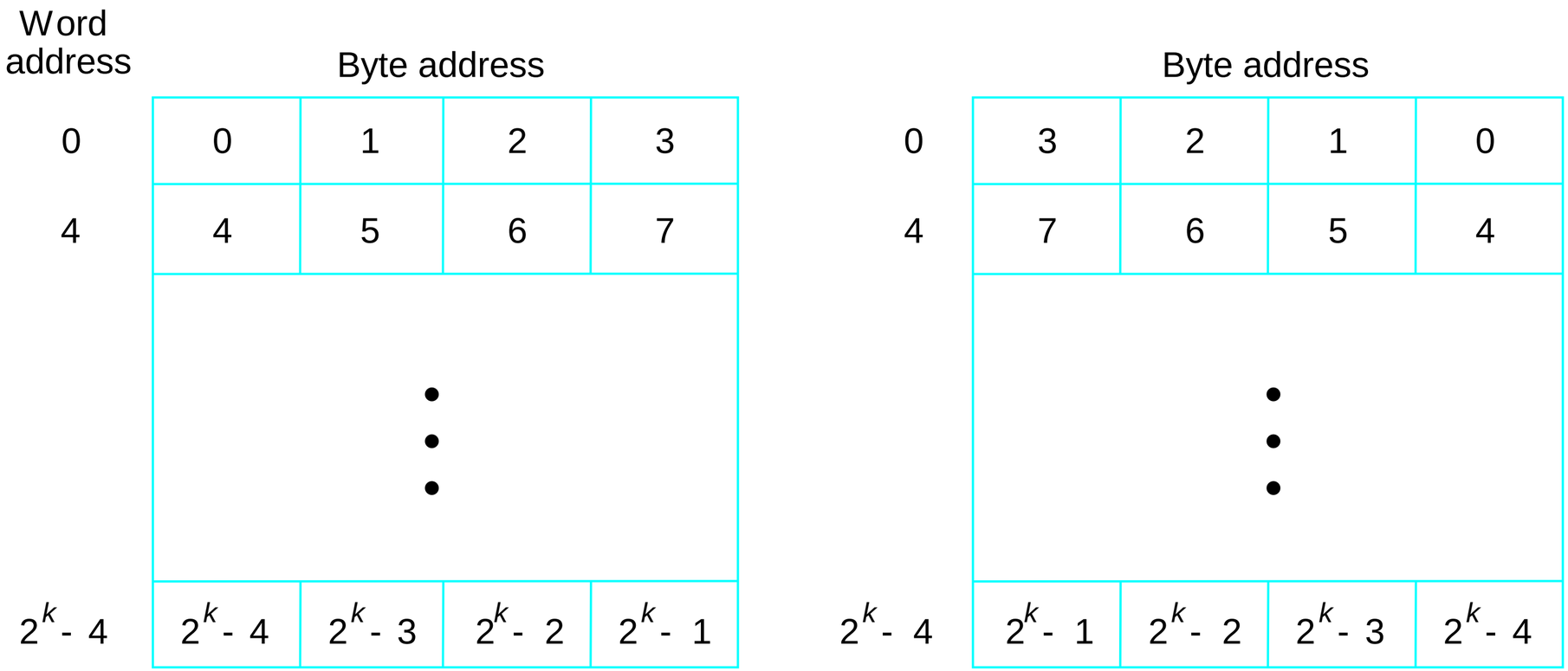
- ✓It is impractical to assign distinct addresses to individual bit locations in the memory.
- ✓The most practical assignment is to have successive addresses refer to successive byte locations in the memory – byte-addressable memory.
- ✓Byte locations have addresses 0, 1, 2, …
- ✓If word length is 32 bits, they successive words are located at addresses 0, 4, 8,…

Address	Memory locations
000	10010011
001	10010111
010	11010011
011	10110011
100	10000011
101	11010011
110	10010001
111	10110010

Memory locations and addresses

Big-Endian assignments: lower byte addresses are used for the most significant bytes of the word

Little-Endian assignments: opposite ordering. lower byte addresses are used for the less significant bytes of the word



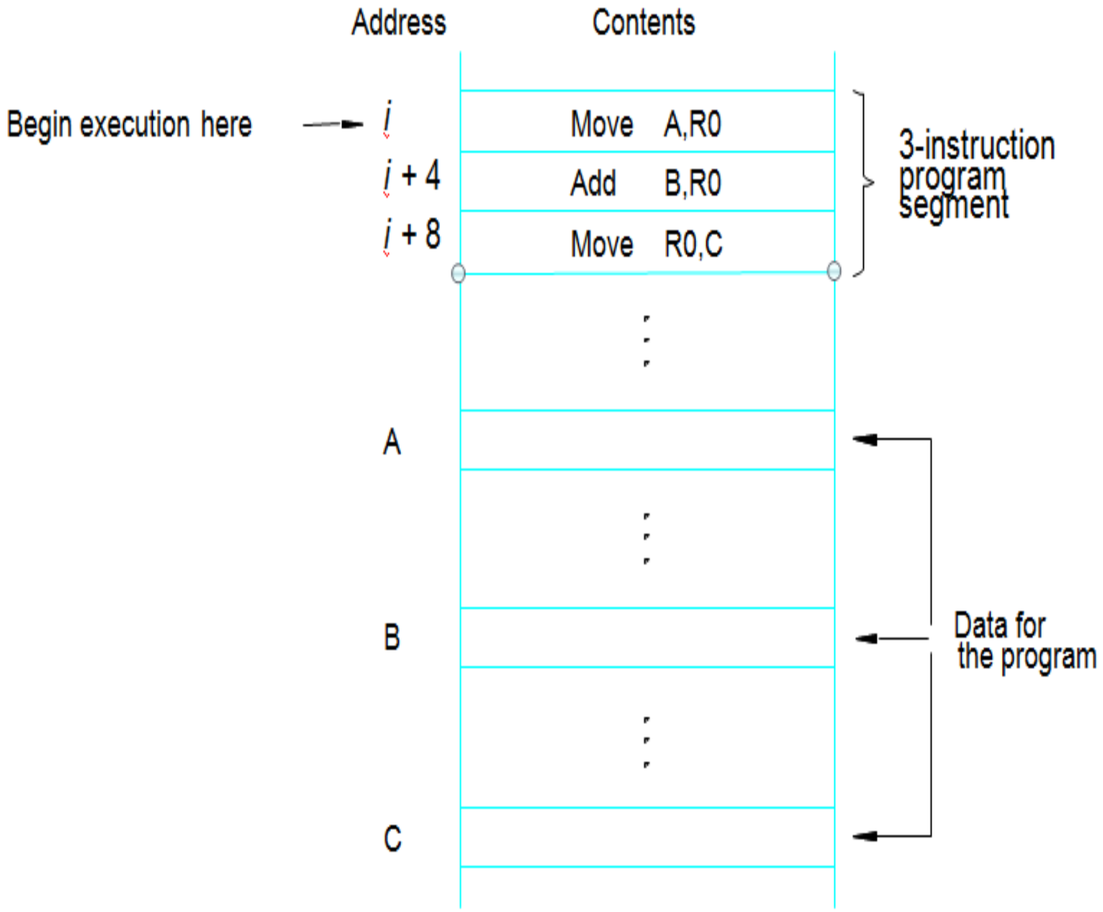
(a) Big-endian assignment

(b) Little-endian assignment

Figure 3 Byte and word addressing.

Memory locations and addresses

- ✓Word alignment
  - ➢Words are said to be aligned in memory if they begin at a byte addr. that is a multiple of the num of bytes in a word.
    - ➢16-bit word: word addresses: 0, 2, 4,….
    - ➢32-bit word: word addresses: 0, 4, 8,….
    - ➢64-bit word: word addresses: 0, 8,16,….
- ✓Access numbers by word address
- ✓ access characters by their byte address
- ✓ access character strings(variable length) by using byte address of first char, end of strings or length of the string in bytes



Memory operations

Load (or Read or Fetch)

- Copy the content from memory using the address present in the instruction.
- The memory content doesn't change.
- Registers can be used to store content
- Load B,R1 ; Load R1 with contents of memory location pointed by B

Store (or Write)

- Write the content (data)in memory using the address present in the instruction.
- Registers can be used to provide content(data)

Store R2,C ; Store contents of R2 to location pointed to by C.

Assessment

a). What is Byte addressing?

_____

_____

_____

b) How do you access the following elements from memory?

1.Numbers_____

2. Characters ____

3.Character strings _____

Reference

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, McGraw-Hill, 6th Edition 2012.

THANK YOU