SNS COLLEGE OF ENGINEERING

Kurumbapalayam (PO), Coimbatore – 641 107
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DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE NAME: 19IT301 COMPUTER ORGANIZATION AND ARCHITECTURE

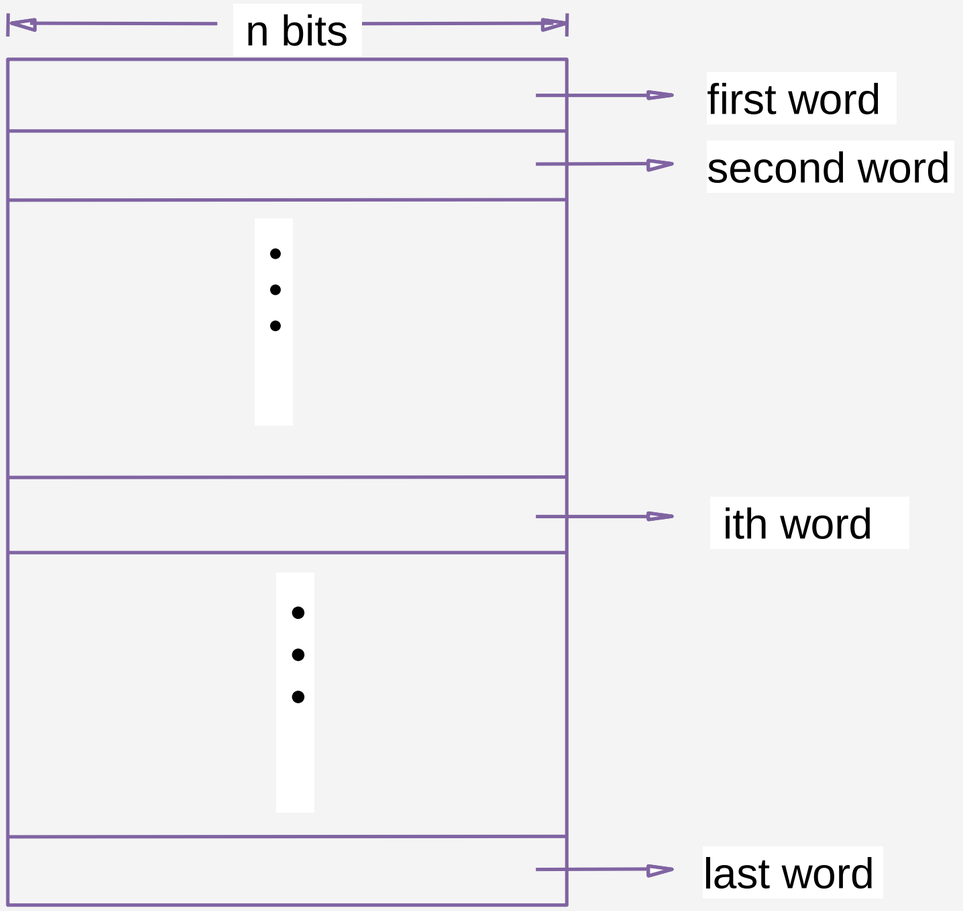
II YEAR/ III SEM

Unit 1 : BASIC STRUCTURE OF COMPUTERS Topic 4:

Memory locations and addresses -Memory Operations

Memory locations and addresses

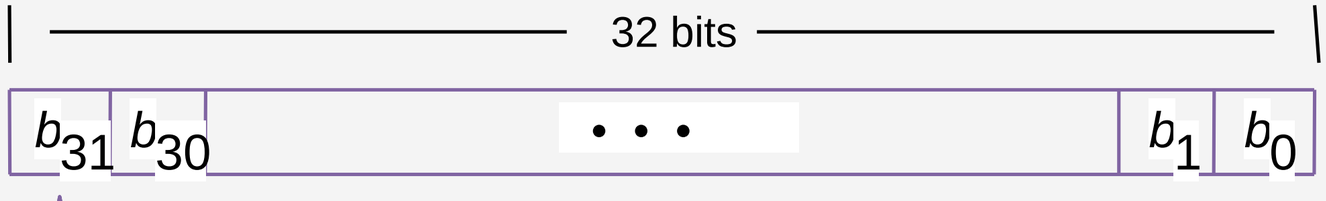
- Memory consists of many millions of storage cells, each of which can store 1 bit.
- Data is usually accessed in *n*-bit groups. *n* is called word length.



Memory words.

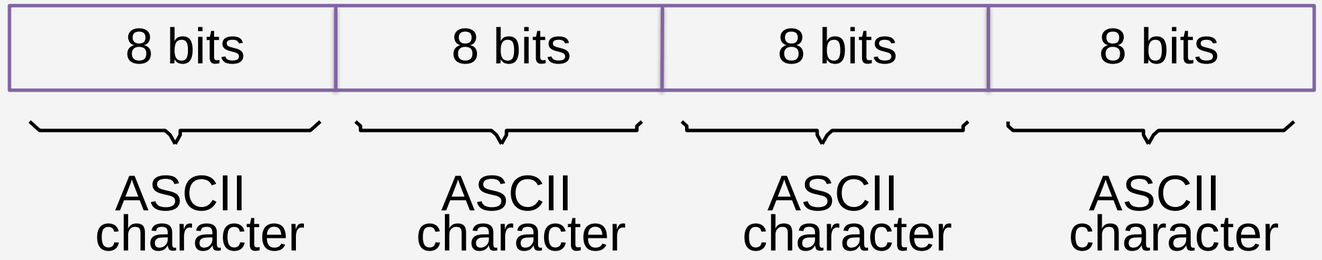
Example of encoded information in a 32-bit word

32-bit word length example



Sign bit: b_{31}=0 for positive numbers
b_{31}=1 for negative numbers

(a) A signed integer



(b) Four characters

Memory Address

- 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.
- 24-bit memory: 2^{24} = 16,777,216 = 16M (1M=2^{20})
- 32-bit memory: 2^{32} = 4G (1G=2^{30})
- 1K(kilo)=2^{10}
- 1T(tera)=2^{40}

Byte Addressability

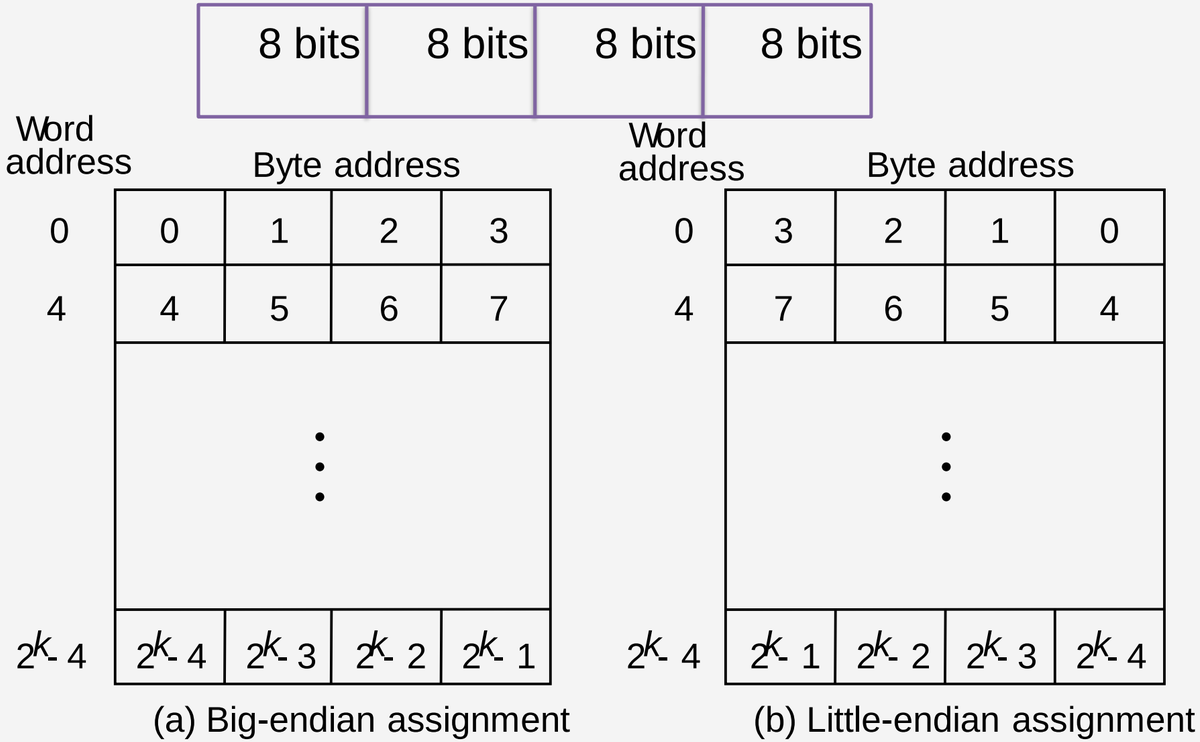
- It is impractical to assign distinct addresses to individual bit locations in the memory.
- The most practical assignment is to have successive addresses refer to successive byte locations in the memory – *byte-addressable memory.*
- Byte locations have addresses 0, 1, 2, … If word length is 32 bits,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

Big-Endian and Little-Endian Assignments

2 ways of assigning byte addresses:

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

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



Byte and word addressing.

Word alignment

- Words are said to be aligned in memory if they begin at a byte addr. that is a multiple of the number 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 using word address, individual characters accessed using byte address, and character strings of variable length by indicating ‘end of string’

Memory Operations

- Load (or Read or Fetch)
  - Copy the content. The memory content doesn’t change.
  - Address – Load
  - Registers can be used
- Store (or Write)
  - Overwrite the content in memory
  - Address and Data – Store
  - Registers can be used

Assessment

1. The smallest entity of memory is called _____
a) Cell
b) Block
c) Instance
d) Unit

2. The collection of the above mentioned entities where data is stored is called _____
a) Block
b) Set
c) Word
d) Byte

Assessment

3. An 24 bit address generates an address space of _____ locations.
a) 1024
b) 4096
c) 248
d) 16,777,216

4. If a system is 64 bit machine, then the length of each word will be _____
a) 4 bytes
b) 8 bytes
c) 16 bytes
d) 12 bytes

Assessment

5. When using the Big Endian assignment to store a number, the sign bit of the number is stored in _____

a) The higher order byte of the word

b) The lower order byte of the word

c) Can’t say

d) None of the mentioned

Thank You