# CSC101
# Introduction to ICT

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# Lecture - 6

## Computer Codes

# Data Types

- Numeric data consists of only numbers, 0, 1, 2, …. , 9
- Alphabetic data consists of only letters A, B, C, …. , Z, in both uppercase and lowercase, and blank character
- Alphanumeric data is a string of symbols where a symbol may be one of the letters A, B, C, … , Z, in either uppercase or lowercase, or one of the digits 0, 1, 2, … , 9, or a special character such as + - * / ( = etc.

# Bit, Byte, and Words

- In binary coding, every symbol that appears in the data is represented by a group of **bits** (Binary Digits)
- The group of bits used to represents a symbol is called a **byte**
- As most modern coding schemes use 8 bits to represents a symbol, the term byte is often used to mean a group of 8 bits

- To differentiate between bits and bytes, bit is written with a small 'b' while byte with a capital 'B'

# Bit, Byte, and Words

- A binary number represented using 8 bits is called a byte
- A less common, 4 bits representation is called nibble
- 16 bits is a word, 32 bits is a double word, and 64 bits is called a quadruple word

- Other quantifiers:
- KILO $1K = 2^{10}$
- MEGA $1M = 2^{20}$
- GIGA $1G = 2^{30}$
- TERA $1T = 2^{40}$
- PETA $1P = 2^{50}$

# Computer Codes

- Computer codes are used for internal representation of data in computers
- As computers use binary numbers for internal data representation, computers codes use binary coding schemes
- Commonly used computer codes are BCD, EBCDIC, ASCII and Unicode

# Computer Codes

- BCD or Binary Coded Decimal
- It is one of the early computer codes
- It uses 6 bits to represents a symbol
- It can represents 64 ($2^6$) different characters

# Computer Codes

| Char | BCD Code | | Octal |
|---|---|---|---|
| | Zone | Digit | |
| A | 11 | 0001 | 61 |
| B | 11 | 0010 | 62 |
| C | 11 | 0011 | 63 |
| D | 11 | 0100 | 64 |
| E | 11 | 0101 | 65 |
| F | 11 | 0110 | 66 |
| G | 11 | 0111 | 67 |
| H | 11 | 1000 | 70 |
| I | 11 | 1001 | 71 |
| J | 10 | 0001 | 41 |
| K | 10 | 0010 | 42 |
| L | 10 | 0011 | 43 |
| M | 10 | 0100 | 44 |

| Char | BCD Code | | Octal |
|---|---|---|---|
| | Zone | Digit | |
| N | 10 | 0101 | 45 |
| O | 10 | 0110 | 46 |
| P | 10 | 0111 | 47 |
| Q | 10 | 1000 | 50 |
| R | 10 | 1001 | 51 |
| S | 01 | 0010 | 22 |
| T | 01 | 0011 | 23 |
| U | 01 | 0100 | 24 |
| V | 01 | 0101 | 25 |
| W | 01 | 0110 | 26 |
| X | 01 | 0111 | 27 |
| Y | 01 | 1000 | 30 |
| Z | 01 | 1001 | 31 |

| Character | BCD Code | | Octal Equivalent |
|---|---|---|---|
| | Zone | Digit | |
| 1 | 00 | 0001 | 01 |
| 2 | 00 | 0010 | 02 |
| 3 | 00 | 0011 | 03 |
| 4 | 00 | 0100 | 04 |
| 5 | 00 | 0101 | 05 |
| 6 | 00 | 0110 | 06 |
| 7 | 00 | 0111 | 07 |
| 8 | 00 | 1000 | 10 |
| 9 | 00 | 1001 | 11 |
| 0 | 00 | 1010 | 12 |

# Computer Codes

- Example:

  The binary digits used to record the word BASE in BCD

  B = 110010

  A = 110001

  S = 010010

  E = 110101

- So, 110010 110001 010010 110101 will record BASE in BCD

# Computer Codes

- EBCDIC or Extended Binary Coded Decimal Interchange Code
- It uses 8 bits to represents a symbol
- It can represents 256 ($2^8$) different characters

# Computer Codes

| Char | EBCDIC Code | | Hex |
|---|---|---|---|
| | Digit | Zone | |
| A | 1100 | 0001 | C1 |
| B | 1100 | 0010 | C2 |
| C | 1100 | 0011 | C3 |
| D | 1100 | 0100 | C4 |
| E | 1100 | 0101 | C5 |
| F | 1100 | 0110 | C6 |
| G | 1100 | 0111 | C7 |
| H | 1100 | 1000 | C8 |
| I | 1100 | 1001 | C9 |
| J | 1101 | 0001 | D1 |
| K | 1101 | 0010 | D2 |
| L | 1101 | 0011 | D3 |
| M | 1101 | 0100 | D4 |

| Char | EBCDIC Code | | Hex |
|---|---|---|---|
| | Digit | Zone | |
| N | 1101 | 0101 | D5 |
| O | 1101 | 0110 | D6 |
| P | 1101 | 0111 | D7 |
| Q | 1101 | 1000 | D8 |
| R | 1101 | 1001 | D9 |
| S | 1110 | 0010 | E2 |
| T | 1110 | 0011 | E3 |
| U | 1110 | 0100 | E4 |
| V | 1110 | 0101 | E5 |
| W | 1110 | 0110 | E6 |
| X | 1110 | 0111 | E7 |
| Y | 1110 | 1000 | E8 |
| Z | 1110 | 1001 | E9 |

| Character | EBCDIC Code | | Hexadecimal Equivalent |
|---|---|---|---|
| | Digit | Zone | |
| 0 | 1111 | 0000 | F0 |
| 1 | 1111 | 0001 | F1 |
| 2 | 1111 | 0010 | F2 |
| 3 | 1111 | 0011 | F3 |
| 4 | 1111 | 0100 | F4 |
| 5 | 1111 | 0101 | F5 |
| 6 | 1111 | 0110 | F6 |
| 7 | 1111 | 0111 | F7 |
| 8 | 1111 | 1000 | F8 |
| 9 | 1111 | 1001 | F9 |

# Computer Codes

- Example:

  The binary digits used to record the work BIT in EBCDIC

  B = 11000010

  I = 11001001

  T = 11100011

- So, 11000010 11001001 11100011 will record BIT in EBCDIC

# Computer Codes

- ASCII or American Standard Code for Information Interchange
- It is of type types, ASCII-7 and ASCII-8
- ASCII-7 uses 7 bits ($2^7$) and ASCII-8 uses 8 bits ($2^8$) to represents a symbol
- First 128 characters in both ASCII-7 and ASCII-8 are same

# Computer Codes

| Character | ASCII-7 / ASCII-8 | | Hexadecimal Equivalent |
|---|---|---|---|
| | Zone | Digit | |
| A | 0100 | 0001 | 41 |
| B | 0100 | 0010 | 42 |
| C | 0100 | 0011 | 43 |
| D | 0100 | 0100 | 44 |
| E | 0100 | 0101 | 45 |
| F | 0100 | 0110 | 46 |
| G | 0100 | 0111 | 47 |
| H | 0100 | 1000 | 48 |
| I | 0100 | 1001 | 49 |
| J | 0100 | 1010 | 4A |
| K | 0100 | 1011 | 4B |
| L | 0100 | 1100 | 4C |
| M | 0100 | 1101 | 4D |

| Character | ASCII-7 / ASCII-8 | | Hexadecimal Equivalent |
|---|---|---|---|
| | Zone | Digit | |
| N | 0100 | 1110 | 4E |
| O | 0100 | 1111 | 4F |
| P | 0101 | 0000 | 50 |
| Q | 0101 | 0001 | 51 |
| R | 0101 | 0010 | 52 |
| S | 0101 | 0011 | 53 |
| T | 0101 | 0100 | 54 |
| U | 0101 | 0101 | 55 |
| V | 0101 | 0110 | 56 |
| W | 0101 | 0111 | 57 |
| X | 0101 | 1000 | 58 |
| Y | 0101 | 1001 | 59 |
| Z | 0101 | 1010 | 5A |

| Character | ASCII-7 / ASCII-8 | | Hexadecimal Equivalent |
|---|---|---|---|
| | Zone | Digit | |
| 0 | 0011 | 0000 | 30 |
| 1 | 0011 | 0001 | 31 |
| 2 | 0011 | 0010 | 32 |
| 3 | 0011 | 0011 | 33 |
| 4 | 0011 | 0100 | 34 |
| 5 | 0011 | 0101 | 35 |
| 6 | 0011 | 0110 | 36 |
| 7 | 0011 | 0111 | 37 |
| 8 | 0011 | 1000 | 38 |
| 9 | 0011 | 1001 | 39 |

# Computer Codes

- Example:

  The binary digits used to record the work BOY in ASCII-7

  B = 1000010

  O = 1001111

  Y = 1011001

- So, 100010  1001111  1011001 will record BOY in ASCII-7

# Computer Codes

- Example:

  The binary digits used to record the work SKY in ASCII-8

  S = 01010011

  K = 01001011

  Y = 01011001

- So, 01010011 01001011 01011001 will record SKY in ASCII-8

# Computer Codes

- Unicode or Universal Code, provides a consistent way to encoding multilingual plain text
- Defines codes for characters used in all major languages of the world
- Defines codes for special characters, mathematical symbols, technical symbols and diacritics
- Capacity to encode as many as million characters
- Assigns each character a unique numeric value and name
- Reserves a part of the code space for private use
- Affords simplicity and consistency for ASCII, even corresponding characters have same code
- Specifies an algorithm for the presentation of text with bi-directional behavior
- Unicode Transformation Format - UTF-8, UTF-16 and UTF-32 variants
- Read more about Unicode at https://unicode-table.com/en/

# THANK YOU