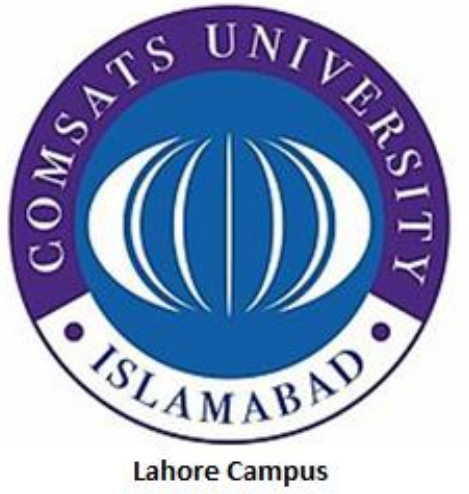

Computer Codes

By: Dr. Jawad Shafi

Agenda:

- Computer data
- Computer codes: representation of data in binary
- Most commonly used computer codes

Data Measurement Chart:

Data Measurement Chart	
Data Measurement	**Size**
Bit	Single Binary Digit (1 or 0)
Byte	8 bits
Kilobyte (KB)	1,024 Bytes
Megabyte (MB)	1,024 Kilobytes
Gigabyte (GB)	1,024 Megabytes
Terabyte (TB)	1,024 Gigabytes
Petabyte (PB)	1,024 Terabytes
Exabyte (EB)	1,024 Petabytes

Data Types

- **Numeric Data** consists of only numbers 0, 1, 2, …, 9
- **Alphabetic Data** consists of only the 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.

Computer Codes

- Computer codes are used for internal representation of data in computers
- As computers use binary numbers for internal data representation, computer codes use binary coding schemes
- In binary coding, every symbol that appears in the data is represented by a group of bits
- The group of bits used to represent a symbol is called a **byte**
- As most modern coding schemes use 8 bits to represent a symbol, the term byte is often used to mean a group of 8 bits
- Commonly used computer codes are BCD, EBCDIC, and ASCII

BCD

- BCD stands for **B**inary **C**oded **D**ecimal
- It is one of the early computer codes
- It uses 6 bits to represent a symbol

EBCDIC

- EBCDIC stands for **E**xtended **B**inary **C**oded **D**ecimal **I**nterchange **C**ode
- It uses 8 bits to represent a symbol

ASCII

- ASCII stands for **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange.
- ASCII is of two types – ASCII-7 and ASCII-8
- ASCII-7 uses 7 bits to represent a symbol and can represent 128 (2^7) different characters
- ASCII-8 uses 8 bits to represent a symbol and can represent 256 (2^8) different characters
- First 128 characters in ASCII-7 and ASCII-8 are same

Coding of Numeric and Alphabetic Characters in ASCII

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

(Continued on next slide)

Coding of Numeric and Alphabetic Characters in ASCII

(Continued from previous slide..)

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

(Continued on next slide)

Coding of Numeric and Alphabetic Characters in ASCII

(Continued from previous slide..)

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

ASCII-7 Coding Scheme

Example

Write binary coding for the word BOY in ASCII-7. How many bytes are required for this representation?

Solution:

B = 1000010 in ASCII-7 binary notation
O = 1001111 in ASCII-7 binary notation
Y = 1011001 in ASCII-7 binary notation

Hence, binary coding for the word BOY in ASCII-7 will be

1000010	1001111	1011001
B	O	Y

Since each character in ASCII-7 requires one byte for its representation and there are 3 characters in the word BOY, 3 bytes will be required for this representation

ASCII-8 Coding Scheme

Example

Write binary coding for the word SKY in ASCII-8. How many bytes are required for this representation?

Solution:

S = 01010011 in ASCII-8 binary notation
K = 01001011 in ASCII-8 binary notation
Y = 01011001 in ASCII-8 binary notation

Hence, binary coding for the word SKY in ASCII-8 will be

01010011	01001011	01011001
S	K	Y

Since each character in ASCII-8 requires one byte for its representation and there are 3 characters in the word SKY, 3 bytes will be required for this representation

Unicode

- **Why Unicode:**
  - No single encoding system supports all languages
  - Different encoding systems conflict
- **Unicode features:**
  - Provides a consistent way of 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

Unicode

- **Unicode features (continued):**
  - Capacity to encode as many as a 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 of ASCII, even corresponding characters have same code
  - Specifies an algorithm for the presentation of text with bi-directional behavior
- **Encoding Forms**
  - UTF-8, UTF-16, UTF-32


Thank You!