In the name of Allah, the Most Merciful, the Most Kind

Date: 08-09-2021

BCS 103
Digital Logic & Computer Architecture

Lecture 1 and 2

Department of Computer Science

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Remember

[1]   The video is being recorded.

[2]   Mute your Mic and turn off your video.

[3]   You can ask questions in last 15 minutes
       of the lecture.

Recommended Books

[1]   Digital Logic and Computer Design
       By Morris Mano

[2]   Digital Computer Electronics
       By Malvino

[3]   Digital Fundamental
       By Floid

Resources

The books, course material, PPTs, assignments and other stuff, you can download from:

1. MS Teams

2. draijaz.quest.edu.pk

Objective of the course

This course is an introduction to the basic principles and concepts of a digital system. It is a foundation to all other computer hardware courses. This course covers **combinational** and **sequential logic circuits**. Upon completion, students should be able to construct, analyze, verify, and troubleshoot digital circuits using appropriate techniques and test equipment.

ANALOG Vs DIGITAL

The following are few that differentiate between analog and digital.

• Analog information is made up of a continuum of values within a given range.

• At its most basic, digital information can assume only one of two possible values: one/zero, on/off, high/low, true/false, etc.

ANALOG Vs DIGITAL

• Digital Information is less susceptible to noise than analog information

• Exact voltage values are not important, only their class (1 or 0)

• The complexity of operations is reduced, thus it is easier to implement them with high accuracy in digital form.

DIGITAL SYSTEMS

Digital means electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number 1 and non-positive by the number 0.

BINARY

Binary describes a numbering scheme in which there are only two possible values for each digit: 0 and 1.

The term also refers to any digital encoding/decoding system in which there are exactly two possible states.

In digital data memory, storage, processing, and communications, the 0 and 1 values are sometimes called "low" and "high," respectively.

BINARY NUMBER SYSTEM

The binary number system is a numbering system that represents numeric values using two unique digits (0 and 1). Most of the computing devices use binary numbering to represent electronic circuit voltage state, (i.e., on/off switch), which considers 0 voltage input as off and 1 input as on.

e.g., $(1010)_2$

Few examples of binary numbers are as follows:
• 10   • 111 • 10101   • 11110

OCTAL NUMBERS

The Octal Number System is another type of computer and digital base number system.

The Octal Numbering System is very similar in principle to the previous hexadecimal numbering system except that in Octal, a binary number is divided up into groups of only 3 bits, with each group or set of bits having a distinct value of between 000 (0) and 111 (7).

Octal numbers therefore have a range of just "8" digits, (0, 1, 2, 3, 4, 5, 6, 7) making them a Base-8 numbering system.

HEXADECIMAL NUMBERING SYSTEM

The one main disadvantage of binary numbers is that the binary string equivalent of a large decimal base-10 number can be quite long. When working with large digital systems, such as computers, it is common to find binary numbers consisting of 8, 16 and even 32 digits which makes it difficult to both read and write without producing errors especially when working with lots of 16 or 32-bit binary numbers.

HEXADECIMAL NUMBERING SYSTEM

One common way of overcoming this problem is to arrange the binary numbers into groups or sets of four bits (4-bits). These groups of 4-bits uses another type of numbering system also commonly used in computer and digital systems called Hexadecimal Numbers

HEXADECIMAL NUMBERING SYSTEM

The "Hexadecimal" or simply "Hex" numbering system uses the Base of 16 system and are a popular choice for representing long binary values because their format is quite compact and much easier to understand compared to the long binary strings of 1"s and 0"s.

Being a Base-16 system, the hexadecimal numbering system therefore uses 16 (sixteen) different digits with a combination of numbers from 0 through to 15. In other words, there are 16 possible digit symbols.
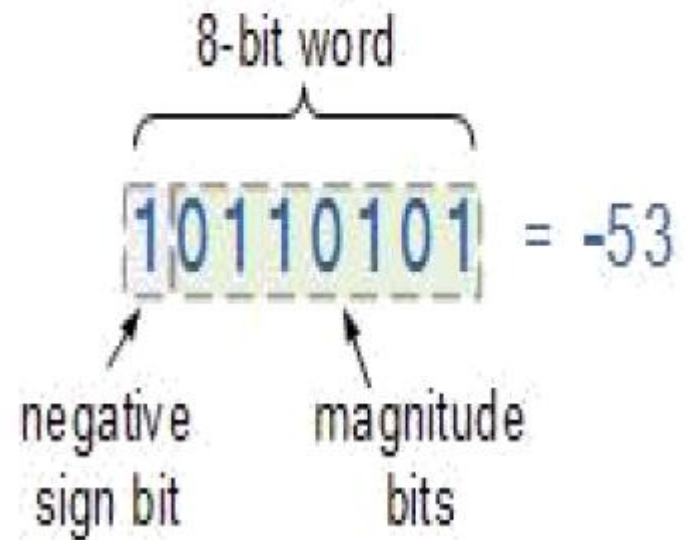
NUMBER SYSTEMS

Decimal	Binary	Octal	Hexadecimal
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

SIGNED BINARY NUMBERS

Positive Signed Binary Numbers.

8-bit word

00110101 = +53

positive sign bit   magnitude bits

Negative Signed Binary Numbers

8-bit word

10110101 = -53
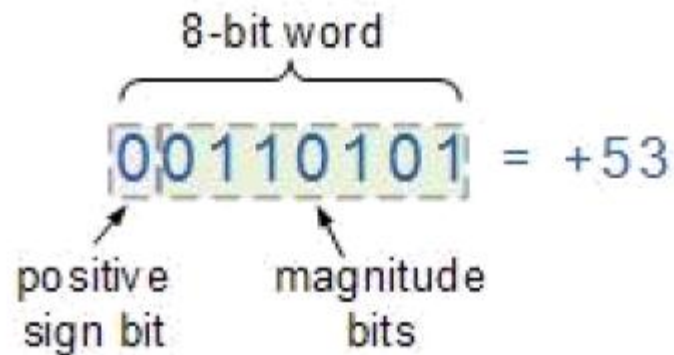
negative sign bit   magnitude bits

BINARY CODES

In the coding, when numbers, letters or words are represented by a specific group of symbols, it is said that the number, letter or word is being encoded.

The group of symbols is called as a code. The digital data is represented, stored and transmitted as group of binary bits. This group is also called as binary code. The binary code is represented by the number as well as alphanumeric letter.

ADVANTAGES OF BINARY CODE

Following is the list of advantages that binary code offers.

- Binary codes are suitable for the computer applications.
- Binary codes are suitable for the digital communications.
- Binary codes make the analysis and designing of digital circuits if we use the binary codes.
- Since only 0 & 1 are being used, implementation becomes easy.

CLASSIFICATION OF BINARY CODES

The codes are broadly categorized into following four categories.

- Weighted Codes
- Non-Weighted Codes
- Alphanumeric Codes
- Error Detecting Codes (parity)

Thanks