Tikrit university
College of Engineering Shirqat
Electrical Engineering Departmen

Code:
Material: Digital technology
Lecture: Diadeen Ali

Lesson 1

Code	Subject	Levels	Semesters	Credits	Study type
EE102	**Digital Technology**	**1st**	**2nd**	6	Mandatory

Teaching scheme: (2 hours lecture and 2 hours laboratory) per week

Course Weekly Outline

Week	Topics Covered
1	Introduction **(Number systems and arithmetic operations)**
2	Digital concepts, General number formula: Binary, Octal, decimal, hexadecimal, and BCD numbers, Gray code, excess-3 code.
3	Numbers conversions and Numbers Arithmetic
4	1's and 2's complement of binary numbers. Signed numbers, arithmetic operations with signed numbers
5	**Logic gates:** Invertor (NOT), AND, OR, NAND, NOR, X-OR and X-NOR gates
6	First Examine
7	Boolean Algebra: Boolean operations and expressions.
8	Law and rules of Boolean algebra,
9	DeMorgans theorems.
10	Boolean analysis of Logic circuits, Canonical and standard forms of Boolean expressions
11	**Logic Simplification:** Boolean expressions and Truth table and Boolean algebra
12	Second Examine
13	The Karnaugh map, Karnaugh map SOP minimization, Karnaugh map POS minimization, Five-variable Karnaugh maps.
14	
15	
16	Final Examine

Course Description:

Objectives:

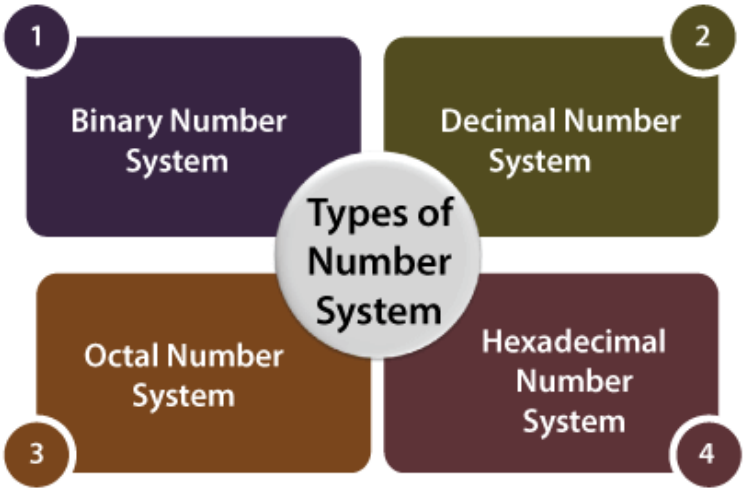
Textbook:

Reference book:

Types of number systems

In the digital computer, there are various types of number systems used for representing information.

1. Binary Number System
2. Decimal Number System
3. Octal Number System
4. Hexadecimal Number System



Decimal Number System:

Decimal number system (base 10)

The base decimal numbers = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

For example: 0, 1, 2, 9, 10, 101, 2023, 5613, 111, 1000, 59876, etc.

Binary Number System:

Binary number system (base 2)

The base binary numbers = {0, 1}

For example: 0, 1, 10, 11, 100, 101, 110, 111, 1000, 1001, etc.

Octal Number System:

Octal number system (base 8)

The base octal numbers = {0, 1, 2, 3, 4, 5, 6, 79}

For example: 0, 1, 2, 7, 10, 101, 2023, 5613, 111, 1000, 57654, etc.

Hexadecimal Number System:

Hexadecimal number system (base 16)

The base numbers = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F}

{ A=10, B=11, C=12, D=13, E=14, F=15 }

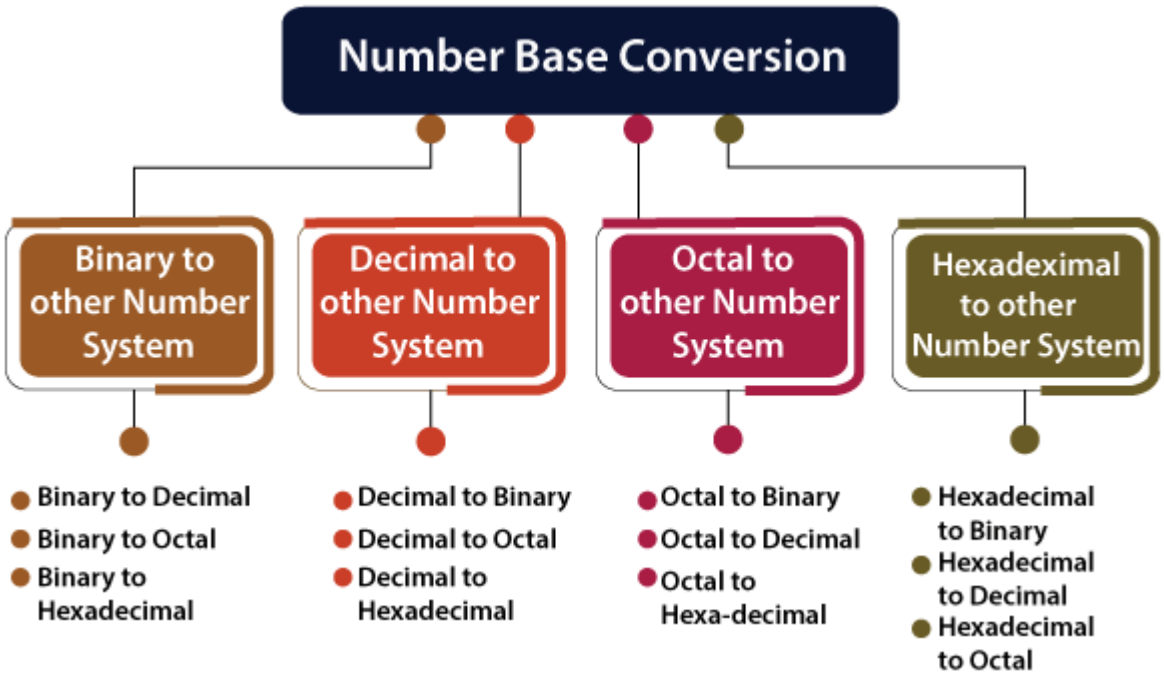
For example: 0, 1, 2, 9, A, F, 10, 5613, 111, 10C0, 59F7E, ect.

Table: Numbers System

Decimal number	*Binary number*	*Octal number*	*Hexadecimal number*
0	**0**	**0**	**0**
1	**1**	**1**	**1**
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	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**
16	10000	20	10
17	10001	21	11
18	10010	22	12

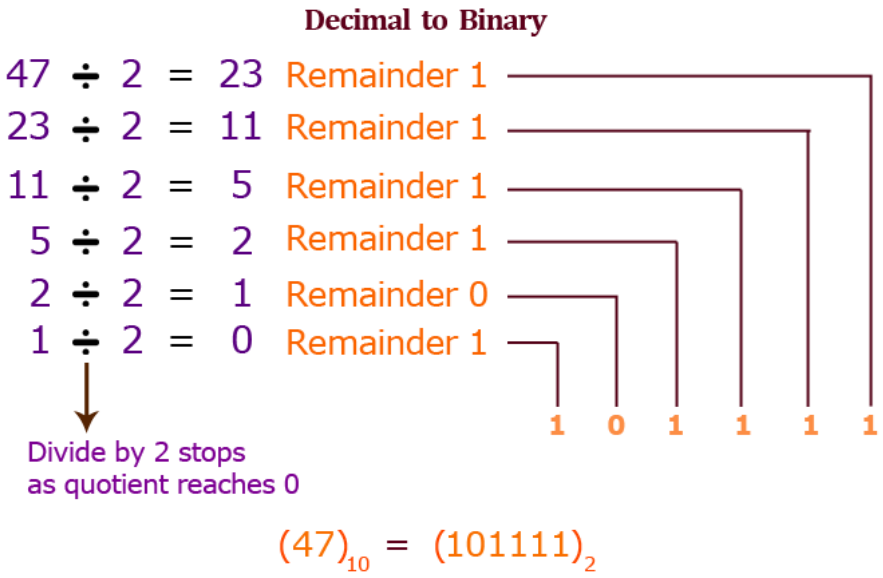
19	10011	23	13
20	10100	24	14
21	10101	25	15
22	10110	26	16
23	10111	27	17
24	11000	30	18

Lesson 2
Number Base Conversion



Convert Decimal Number to Binary Number

Example 1: **Convert $(47)_{10}$ to Binary number.**



$(47)_{10} = (101111)_2$

Example 2: **Convert $(152)_{10}$ to Binary number.**

Operation	Remainder	Notes
152 ÷ 2 = 76	0	LSB
76 ÷ 2 = 38	0	
38 ÷ 2 = 19	0	
19 ÷ 2 = 9	1	
9 ÷ 2 = 4	1	
4 ÷ 2 = 2	0	
2 ÷ 2 = 1	0	
1 ÷ 2 = 0	1	MSB

$(152)_{10} = (10011000)_2$

Home work: Convert Decimal number to Binary number.

127	23	1264	84	50

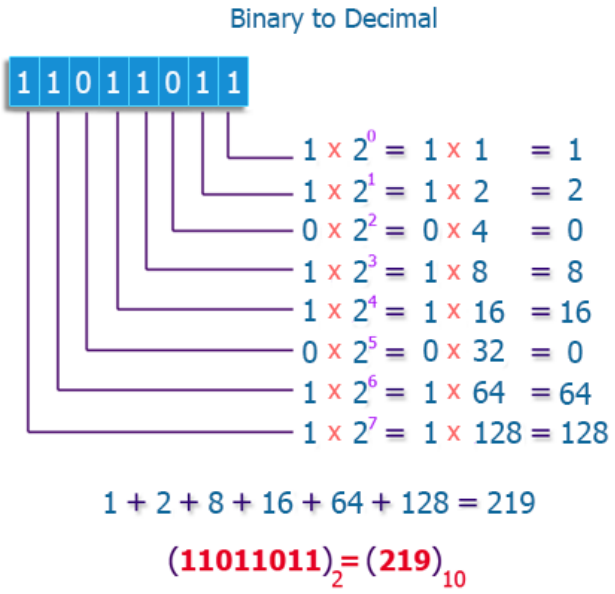
Convert Binary Number to Decimal Number

The process of converting binary to decimal is quite simple. The process starts from multiplying the bits of binary number with its corresponding positional weights. And lastly, we add all those products.

Let's take an example to understand how the conversion is done from binary to decimal.

Example 1:

Convert $(11011011)_2$ to decimal number.



Example 2: Convert $(10110)_2$ to decimal number

$(10110)_2 = (1\times2^4) + (0\times2^3) + (1\times2^2) + (1\times2^1) + (0\times2^0)$

$(10110)_2 = (1\times16) + (0\times8) + (1\times4) + (1\times2) + (0\times1)$

$(10110)_2 = 16 + 0 + 4 + 2 + 0$

$(10110)_2 = (22)_{10}$

Notes:

Positive Powers of 2		Comments	Negative Powers of 2	
2^0	1		2^{-1}	0.5
2^1	2		2^{-2}	0.25
2^2	4		2^{-3}	0.125
2^3	8		2^{-4}	0.0625
2^4	16		2^{-6}	0.015625
2^5	32		2^{-7}	0.0078125
2^6	64		2^{-8}	0.00390625
2^7	128		2^{-9}	0.001953125
2^8	256		2^{-10}	0.0009765625
2^9	512			
2^{10}	1024	K-byte		
2^{11}	2048	2k-byte		
2^{12}	4096	4k-byte		
2^{15}	32768	8k-byte		
2^{20}	1048576	M-byte		
2^{30}	1073741824	G-byte		

Home work: Convert the following of (Binary number) to decimal number

$(10100.1)_2$	$(11011.101)_2$	$(11001)_2$	$(100101.011)_2$	$(0.1011)_2$