ECE213: Digital Electronics

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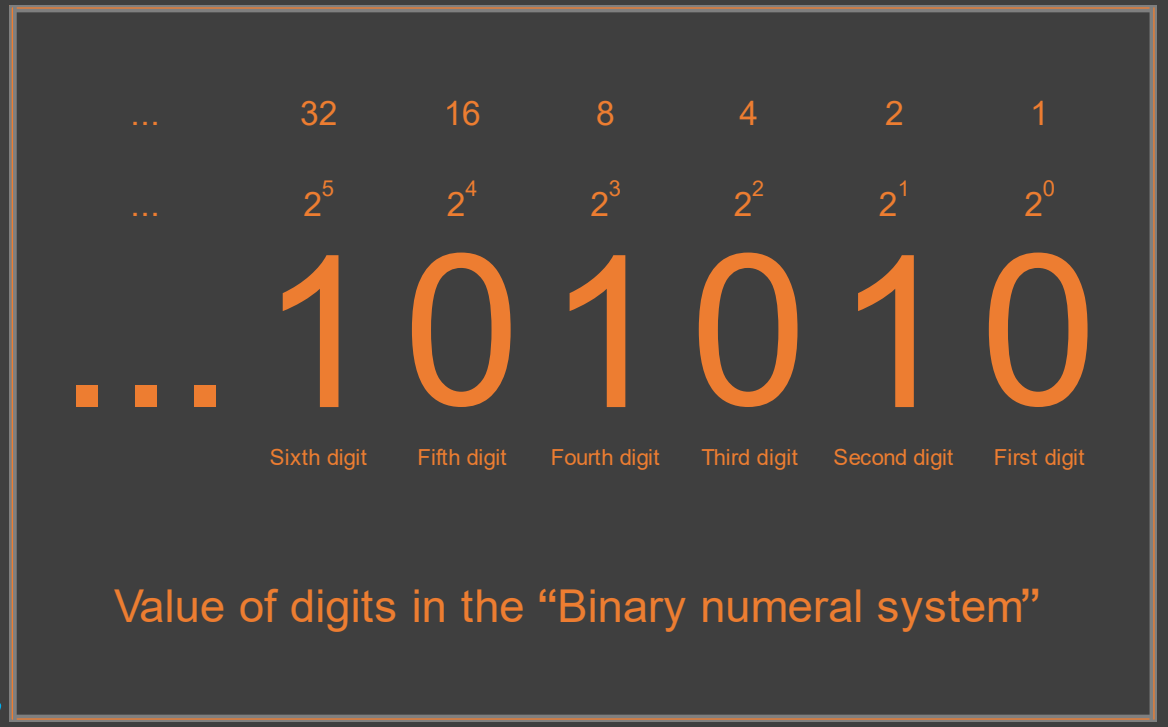
The Course Contents

Unit I

Number Systems : Digital Systems, Data representation and coding, Logic circuits, Implementation of digital systems, Number Systems, Codes- Positional number system, Binary number system, Methods of base conversions, Binary arithmetic, Representation of signed numbers, Fixed numbers, Binary coded decimal codes, Gray codes, Error detection code, Parity check codes, octal number system, Hexadecimal number system, Error correction code, Hamming code, Octal arithmetic, Hexadecimal arithmetic, Floating point numbers



Value of digits in the “Binary numeral system”

Number Systems

Binary coded decimal codes

Ex $(0.25)_{10} \rightarrow (0.01)_2$

$0.25 \times 2 = 0.5 \quad 0$

$.5 \times 2 = 1.0 \quad 1$

$.0 \times 2 = 0.0 \quad 0$

$2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}$

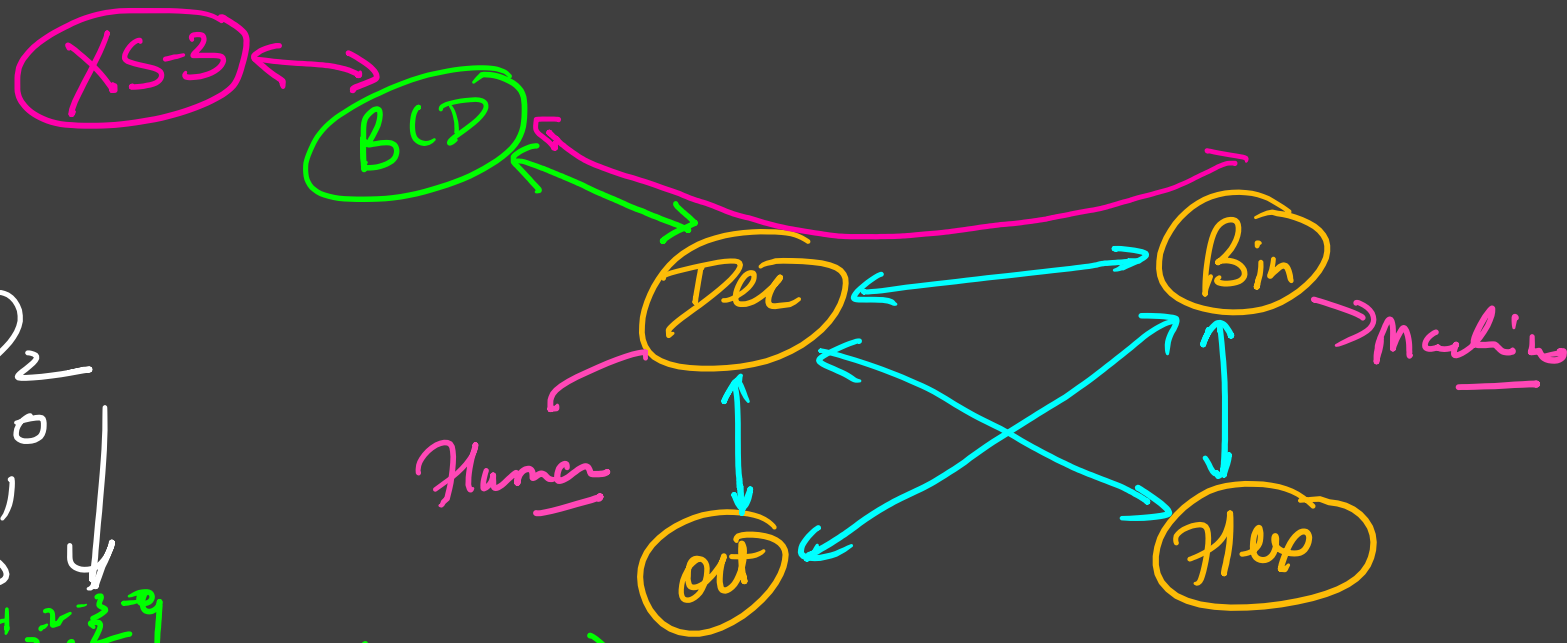
Ex $(0.33)_{10} \rightarrow (0.0101)_2 = (0.3125)_{10}$

$0.33 \times 2 = 0.66 \quad 0$

$.66 \times 2 = 1.32 \quad 1$

$.32 \times 2 = .64 \quad 0$

$.64 \times 2 = 1.28 \quad 1$



Dec → Div → Bin

Dec ← Multi ← Bin

Time consuming

Number Systems

Binary coded decimal codes (BCD code) or $2^3 2^2 2^1 2^0$ 8421 Code

★ These are the Binary codes for decimal digits.

Decimal digits	BCD (8421)
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

lookup table →

valid BCD

MCQ

Invalid BCD Code

1010
1011
1100
1101
1110
1111

Ex $(0.25)_{10} = (0000.0010\ 0101)_{BCD}$

Ex $(0.33)_{10} = (0000.0011\ 0011)_{BCD}$

Number Systems

Binary coded decimal codes

Ex Find the BCD codes of the following numbers

(i) $(0.325)_{10} = (0000.0011\ 0010\ 0101)_{BCD}$

(ii) $(231.73)_{10}$ $(0010\ 0011\ 0001.0111\ 0011)_{BCD}$

Ex Find the Dec. number of the following BCD codes.

(i) $(1011.0110\ 1001\ 0011)_{BCD} = (13.693)_{10}$

(ii) $(110001.1001\ 0111\ 1101)_{BCD} = 31.97$

✗ Invalid.

Number Systems

Binary coded decimal codes

Ex Find the BCD code of the following numbers

(i) $(0.011)_2 = (0.25 + 0.125)_{10} = (0.375)_{10} = (0000.0010111010)_{BCD}$

(ii) $(731)_8 = (473)_{10} = (0100\ 0111\ 0011)_{BCD}$.

$8^2\ 8^1\ 8^0$

Number Systems

Binary coded decimal codes

Eg. $(-5)_{10}$

0101

1010

Invalid BCD

Number Systems

XS-3 Codes

Ex Find the XS3 code of $(7)_{10}$

$(7)_{10} \xrightarrow{BD}$ 0111
0011
$(1010)_{XS3}$

Ex Find the XS3 code of $(72)_{10}$

$(72)_{10} \xrightarrow{BCD}$ 0111 0010
0011 0011
$(1010\ 0101)_{XS3}$

Number Systems

XS-3 Codes

Dec Digit	BCD	XS-3
0	0000	0011
1	0001	0100
2	0010	0101
3	0011	0110
4	0100	0111
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

Self Complimy Code

List of invalid XS3

0000
0001
0010
1101
1110
1111

Number Systems

Gray codes

0 0 0 → 1-bit
0 0 1 → 2-bit
1 0 → 1-bit
0 1 1 → 3-bit
1 0 0 → 1-bit
1 0 1 → 2-bit
1 1 0 → 1-bit
1 1 1 → 4-bit
1 0 0 0
1 0 0 1
1 0 1 0

1 0 1 1
1 1 0 0
1 1 0 1
1 1 1 0
0 1 1 1 1 → 5-bit
1 0 0 0 0
1 0 0 0 1
1 0 0 1 0
1 0 0 1 1

★ Bin to Gray

★ Gray to Bin