ECE213: Digital Electronics

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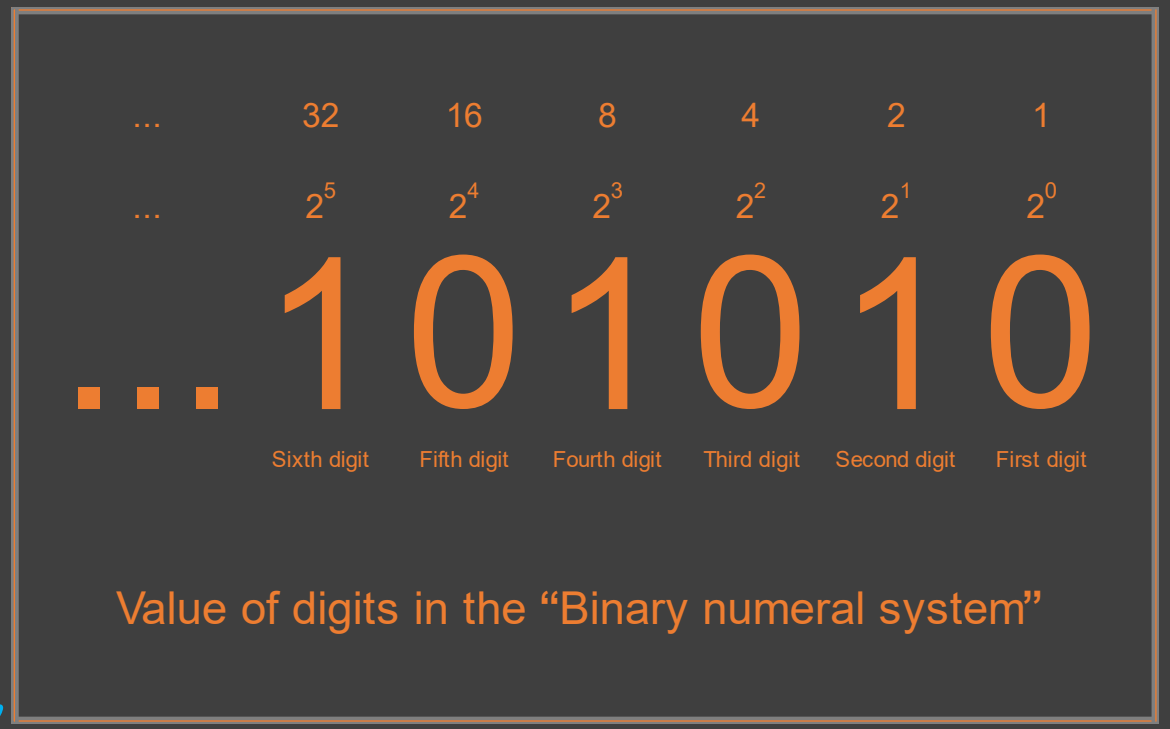
The Course Contents

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

Representation of signed numbers

We require the sign bit/digit.

The range is

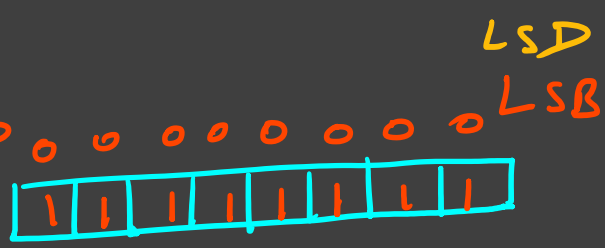
$-\infty$ ——— 0 ——— $+\infty$

Ex $-7, +21, -31$

sign — Mag

Q: What is the max number in 8-bit signed representation?

A: $(2^{n-1}-1) = 127$



$(2^n - 1)$ is the max n-bit number for unsigned representation

99,999

The range of n-bit unsigned number is

$0 - (2^n - 1)$

$0 - 255$

Note: How to detect the sign of a signed number.

- If the sign bit/digit is zero (0), it indicate the no. is +ve
- If the sign bit/digit is non-zero, it indicate the no. is -ve

Ex The oct number 732 in signed representation is

-ve

+ve

-ve

Number Systems

Representation of signed numbers

Ex: Oct

72	-ve
75	-ve
02	+ve
317	-ve
023	+ve
567	-ve

Non-zero

zero

Hex

A13	-ve
217	-ve
03B	+ve
C12	-ve
0AC	+ve

Dec

913	-ve
021	+ve
732	-ve
890	-ve
800	-ve
70	-ve

In 3-digit oct signed numbers, identify the sign of the following numbers

321	-ve
071	+ve
023	+ve

571	-ve
077	+ve
010	+ve

Number Systems

Representation of signed numbers

	Bin	Oct	Hex	Dec
1) Sign-Mag format	sign-mag	sig-mag	sig mag	sig mag
2) (r-1)'s Complement format	1's	7's	F's	9's
3) r's Complement format	2's	8's	16's	10's

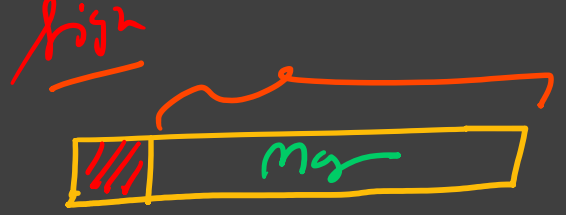
When r is radix / base

☆ To represent the sign number, mention / write

(i) Zero (0) for +ve
(ii) (r-1) for -ve

Number Systems

Representation of signed numbers



Sign-Mag format

Ques Represent the following numbers into sign-mag format

	(i) $+7$	(ii) -21	(iii) $+17$	(iv) -31
Bin (Mg)	111	10101	10001	11111
sign mg fmt	0111	110101	010001	111111
Oct (Mg)	7	25	21	37
sign mg fmt	07	725	021	737
Hex (Mg)	7	15	11	1F
sign mg fmt	07	F15	011	F1F
Dec (Mg)	7	21	17	31
sign mg fmt	07	921	017	931

Number Systems

Representation of signed numbers

Ant use 8-bit and 4-digit for

(i) +7

Bin 00000111

Sign 0 0000111

Ort 007

Sign 0 007

(ii) −21

00|0|01

100|0|01

025

7025