Lec-2

Digital Logic

(Book : M. Morris Mano)

Binary Logic → consists of binary variable and logical operations

A, B, C, D, x, y, z

AND, OR, NOT
NAND

Binary Numbers : Base - 2

Decimal number, base-10, 7392 (3 2 1 0)

base-r

$7 \times 10^3 + 3 \times 10^2 + 9 \times 10^1 + 2 \times 10^0$

Coefficients, 0, 1, 2, 3, ..., (r-1)

Octal (Base-8), coefficients, [0, 1, 2, 3, 4, 5, 6, 7]

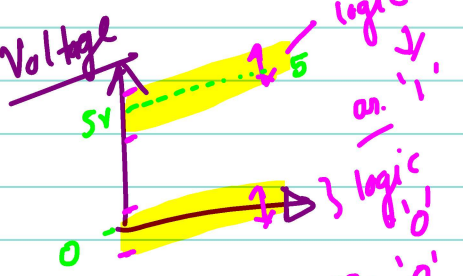
Binary coefficients. [0, 1]

Binary number system [Base-2]

coefficient, base, power

$(101)_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = (5)_{10}$

2 1 0 (power), base, coefficients.



$(5)_{10} \rightarrow (\ ?\ )_2$

$(5)_{10} \rightarrow (101)_2$

2 | 5	
2 | 2	− 1
2 | 1	− 0
	0 − 1

Decimal to binary

2 | 41	
2 | 20	1
2 | 10	0
2 | 5	0
2 | 2	1
2 | 1	0
0	1

$(41)_{10} = (101001)_2$ (5 4 3 2 1 0)

$1\times2^5 + 0\times2^4 + 1\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0$

$32 + 8 + 1$

$(41)_{10}$

$(41.6875)_{10} = (?)_2$

coefficient before decimal point.

$0.6875 \times 2 = 1.03750 \rightarrow 1$

$0.03750 \times 2 = 0.0750 \rightarrow 0$

$0.0750 \times 2 = 1.500 \rightarrow 1$

$0.500 \times 2 = 1.000 \rightarrow 1$

power.

$(0.6875)_{10} = (0.1011)_2$ (-2 -3 -4)

$(41.6875)_{10} = (101001.1011)_2$

41

$1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3} + 1\times2^{-4}$

$0.5 + 0 + \frac{1}{8} + \frac{1}{16}$

$= 0.5 + 0.125 + 0.0625$

$= 0.6875$

$0.11001\ldots$

$\frac{10}{3} = 3.3333\ldots\ldots$

$5.32145 \rightarrow 5.32$

$(0.3333)_{10} = (?)_2 = (0.01010\ldots\ldots)_2$

$0.3333 \times 2 = 0.6666 \rightarrow 0$

$0.6666 \times 2 = 1.3332 \rightarrow 1$

$0.3332 \times 2 = 0.6664 \rightarrow 0$

$0.6664 \times 2 = 1.3328 \rightarrow 1$

$0.3328 \times 2 = 0.6656 \rightarrow 0$

⋮ ⋮

H.W: $(0.23)_{10} \rightarrow (\quad)_8$

Octal (base-8)

$(153)_{10} = (?)_8$

$= (231)_8$

$(153)_8 \rightarrow (\quad)_2$

$2 \times 8^2 + 3 \times 8^1 + 1 \times 8^0$

$= 128 + 24 + 1$

$= 153$

$(153)_{10}$

8 | 153	
8 | 19	— 1
8 | 2	— 3
0	— 2

011

$(231)_8 = (010011001)_2$

010 001

$(153)_{10}$

$(010011001)_2 \rightarrow (231)_8$

2 3 1

not possible $[0, (r-1)]$

Convert $(38)_8 = (?)_{10}$

Hexadecimal (Base 16)

$(1B8)_{16} = (?)_{10}$

$= 1 \times 16^2 + 11 \times 16^1 + 8 \times 16^0$

$= 256 + 176 + 8$

$= (440)_{10}$

0
1
2
⋮
9
A – 10
B – 11
C – 12
D – 13
E – 14
F – 15

16 | 440
16 | 27 — 8
16 | 1 — 11
0 — 1

$(1B8)_{16}$ $(440)_{10}$

$(1B8)_{16} = (0001\ 1011\ 1000)_2$

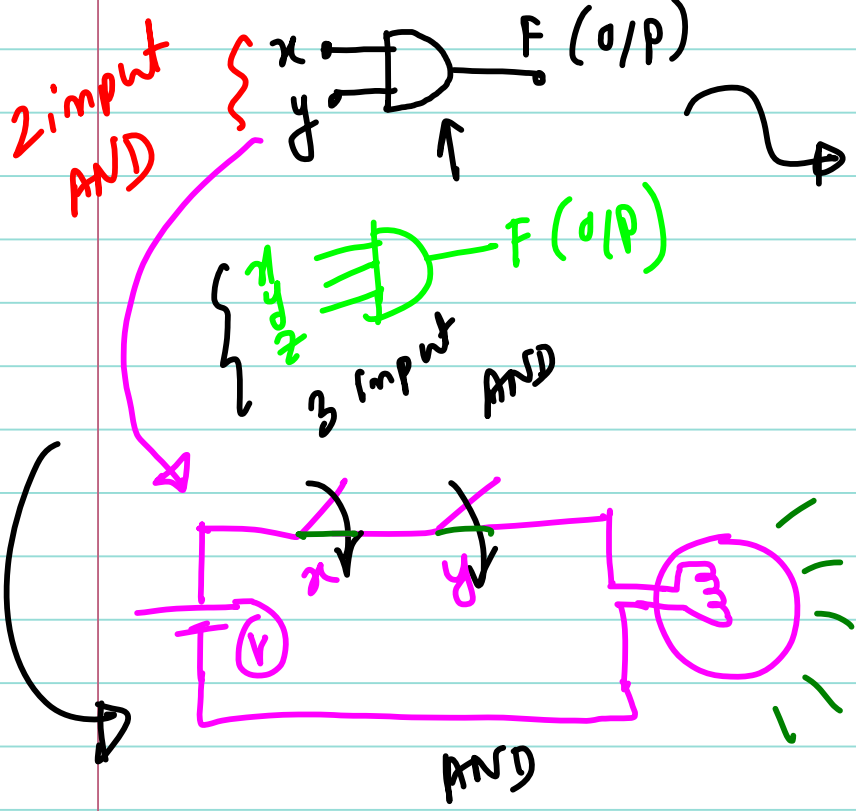
1000

Digital Logic Gates:

A, B, C
x, y, z

① AND (·)

$x \cdot y = xy$



x	y	F
0	0	0
0	1	0
1	0	0
1	1	1

Truth Table

x	y	z	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

$2^3 = 8$

3 input AND