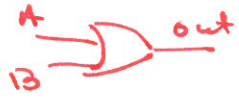
Gates, algebra, truth table, TTL IC

AND 

$A \cdot B = out$

A	B	out
0	0	0
0	1	0
1	0	0
1	1	1

quad AND = 7408

OR 

$A + B = out$

A	B	out
0	0	0
0	1	1
1	0	1
1	1	1

quad OR = 7432

INVERT 

$\overline{A} = out$

A	out
0	1
1	0

hex INVERT = 7404

BUFFER 

$A = out$

A	out
0	0
1	1

hex BUFFER = 74365

XOR 

$A \oplus B = out$

A	B	out
0	0	0
0	1	1
1	0	1
1	1	0

quad XOR = 7486

NAND 

$\overline{A \cdot B}$

A	B	out
0	0	1
0	1	1
1	0	1
1	1	0

quad NAND = 7400

NOR 

$\overline{A + B}$

A	B	
0	0	1
0	1	0
1	0	0
1	1	0

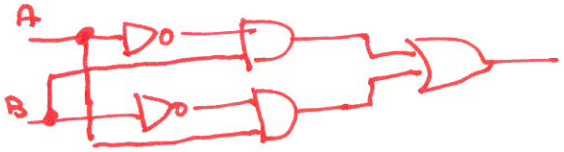
quad NOR = 7402

XNOR 

$\overline{A \oplus B}$

A	B	
0	0	1
0	1	0
1	0	0
1	1	1

quad XNOR = 74266

Note: combine : eg 

$A \cdot \overline{B} + \overline{A} \cdot B = A \oplus B$

Number systems: $351_{10} = 3\times10^2 + 5\times10^1 + 1\times10^0$

"hex" = base 16 (needs extra digits A=10, ..., F=15) "octal" = base 8 "binary" = base 2

conversion binary → hex / octal easy: just group 4 / 3

conversion decimal → binary: find if powers-of-2

fit: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, ...

Eg $351 - 256 = 95 - 64 = 31 - 16 = 15 - 8 = 7 - 4 - 2 - 1$ ← 111

(No 128, No 32)

5 3 7 ← octal

1 0 1 0 1 1 1 1

1 5 F ← hex

Note: in base r: $x = a\cdot r^2 + b\cdot r + c = abc_r$

$r \overline{)x}$ remainder c

$r \overline{)ab}$ remainder b

$r \overline{)a}$ remainder a

$16 \overline{)351}$ 21, $15 = F$

$16 \overline{)21}$ 1, 5

$16 \overline{)1}$ 0, 1

$15F_{16}$

parallel binary number: the 0 or 1 digits of the number occur on different wires from most significant digit = MSD to least significant digit = LSD

serial binary number: the 0 or 1 digits of the number occur over time on one wire; the time a bit is present is just the inverse of the #bits/sec = baud rate.