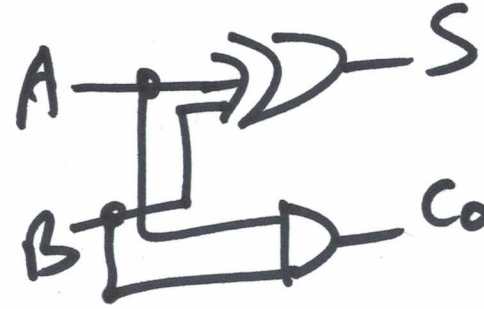


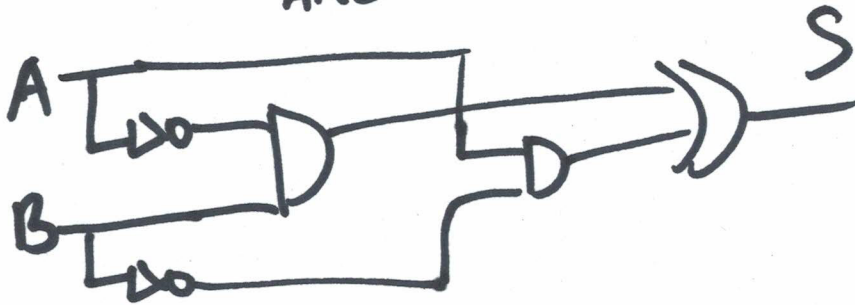
① HA (Half Adder)

A	B	S	Co
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



Minterms:

$$\left\{ \begin{array}{l} S = \bar{A}B + A\bar{B} \quad \equiv \oplus \text{ XOR} \\ Co = AB \quad \uparrow \text{ AND} \end{array} \right.$$



② FA (Full Adder)
Ripple carry FA (RCA)

A	B	C _i	S	C _o
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

S:

A \ B C _i	00	01	11	10
0		1		1
1	1		1	1

$$S = \bar{A}\bar{B}C_i + \bar{A}B\bar{C}_i + A\bar{B}\bar{C}_i + ABC_i$$

$$= (\bar{A}\bar{B} + AB)C_i + (\bar{A}B + A\bar{B})\bar{C}_i$$

$$= (A \odot B)C_i + (A \oplus B)\bar{C}_i$$

$$= (\overline{A \oplus B})C_i + (A \oplus B)\bar{C}_i$$

$$= A \oplus B \oplus C_i$$

$$A \odot B = \overline{A \oplus B}$$

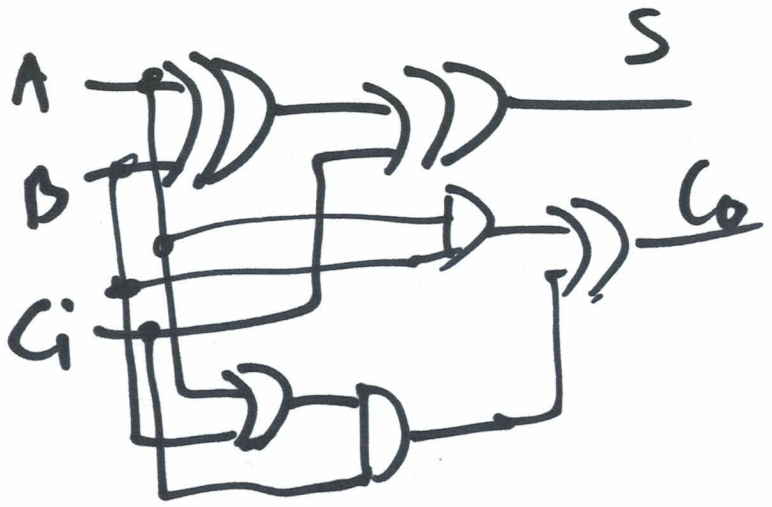
C_0 :

A \ BC _i	00	01	11	10
0	0	0	1	0
1	0	1	1	1

$$C_0 = AC_i + BC_i + AB$$

$$= (A+B)C_i + AB$$

~~$A^1 B^1 C_i$~~

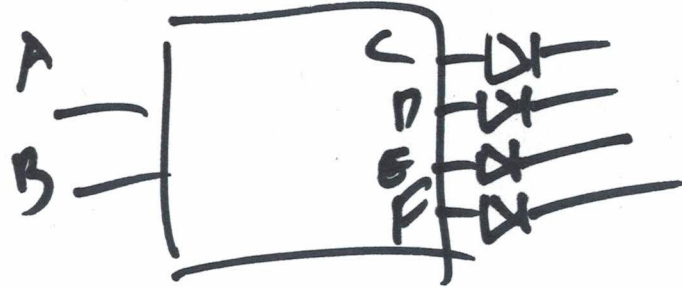


③

Decoder
2-4 decoder

A	B	C	D	E	F
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

A	B	C	D	E	F	G	H
0	0	1	1	0	0	1	1
0	1	0	0	1	1	0	0
1	0	1	0	1	0	1	1
1	1	1	0	1	0	0	0



$$\begin{aligned}
 C &: (\bar{A}\bar{B} + A\bar{B} + AB) \\
 &= \bar{A}\bar{B} + A(\bar{B} + B) \\
 &= \bar{A}\bar{B} + A \\
 &\Downarrow \\
 &= A + \bar{B}
 \end{aligned}$$

$$\begin{aligned}
 &A(\bar{A} + A) + \bar{A}\bar{B} \\
 &= \underline{A\bar{A}} + AA + \bar{A}\bar{B} \\
 &= (A + \bar{A})\bar{A} + AA
 \end{aligned}$$

A	B	C	parity
0	0	1	1
0	1	1	0

even parity
generator
(transmitter side)



even parity
checker
(receiver side)

check if
there are even # of 1's in the package