

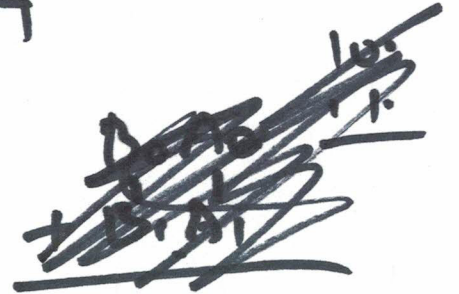
Full Adders (FA)

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



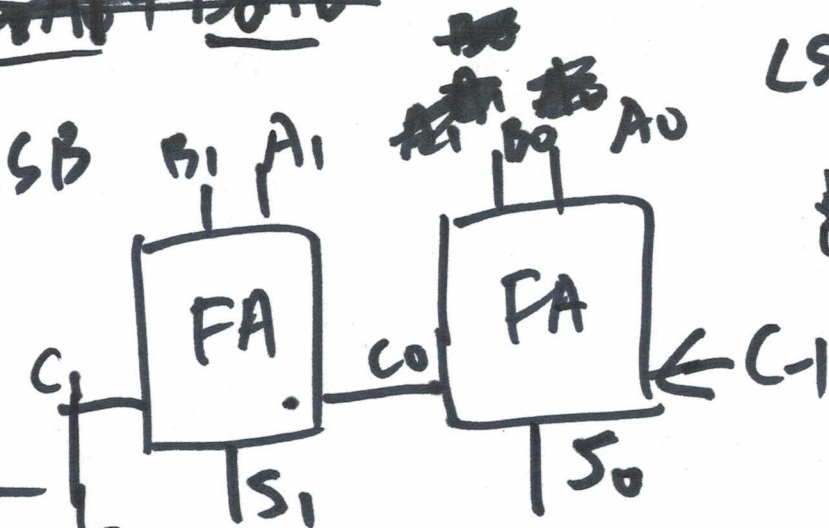
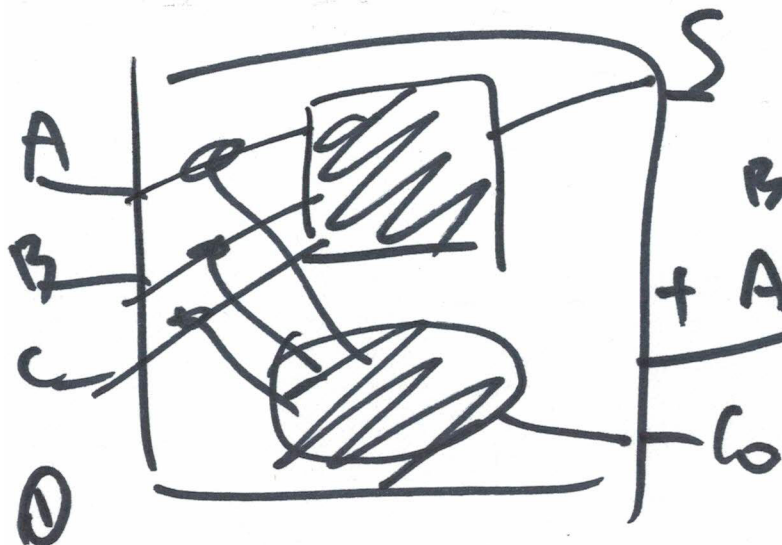
1-bit
FA

$$\begin{array}{r} A \\ + B \\ \hline \end{array}$$



~~$$\begin{array}{r} C_o \\ + A_1 A_0 \\ + B_1 B_0 \\ \hline \end{array}$$~~

MSB B₁ A₁ ~~A₁ B₁~~ ~~A₀ B₀~~ LSB



$C_1 S_1 S_0$

S:

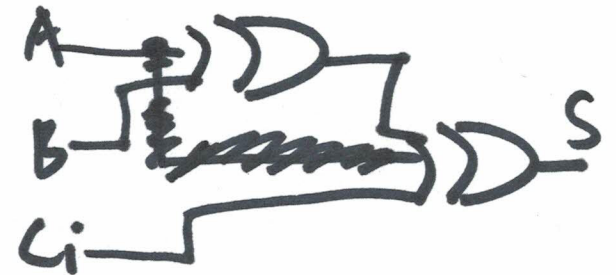
A \ B C _i	00	01	11	10
0		1		1
1	1		1	

$$XOR = \overline{X NOR}$$

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

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

$$= (A \oplus B) \oplus C_i = \underline{A \oplus B \oplus C_i}$$

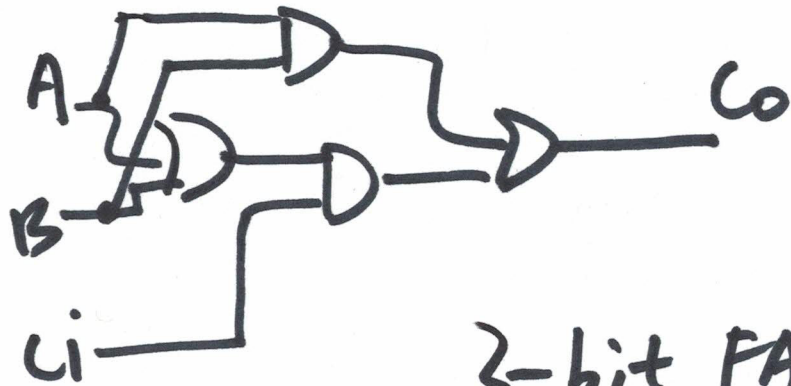


C₀:

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

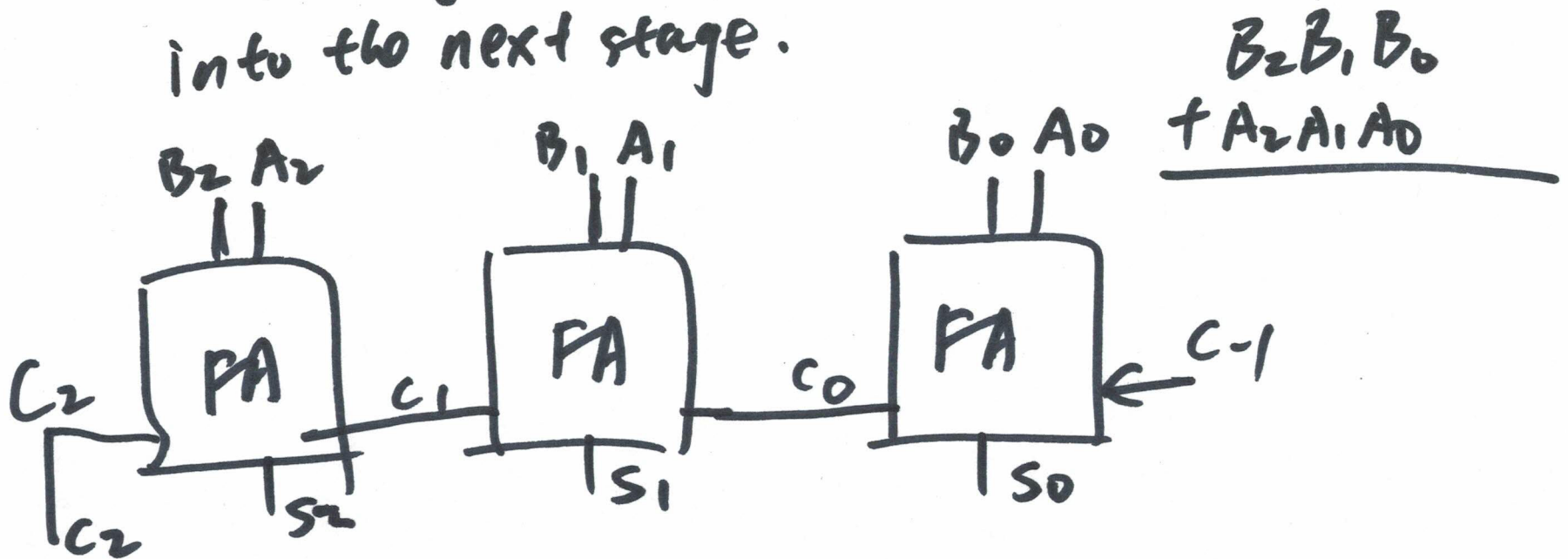
$$C_0 = B C_i + A C_i + A B$$

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



3-bit FA Ripple Carry FA (RCA)

Carry out of each FA is the carry in of the succeeding FA. Each carry bit gets rippled into the next stage.



2's Complement

$$\underline{100} : -4$$

$$101 : -4 + 1 = -3$$

$$011 + 3$$

$$\begin{array}{r} 100 \\ + 1 \\ \hline 101 \end{array} -3$$

$$\begin{aligned} & B_2 B_1 B_0 - A_2 A_1 A_0 \\ &= B_2 B_1 B_0 + (-A_2 A_1 A_0) \end{aligned}$$

$$0101 + 5$$

$$\begin{array}{l} -5 \\ \swarrow \quad \searrow \\ 1010 + 1 = 1011 \\ \underline{\underline{1011}} \end{array}$$