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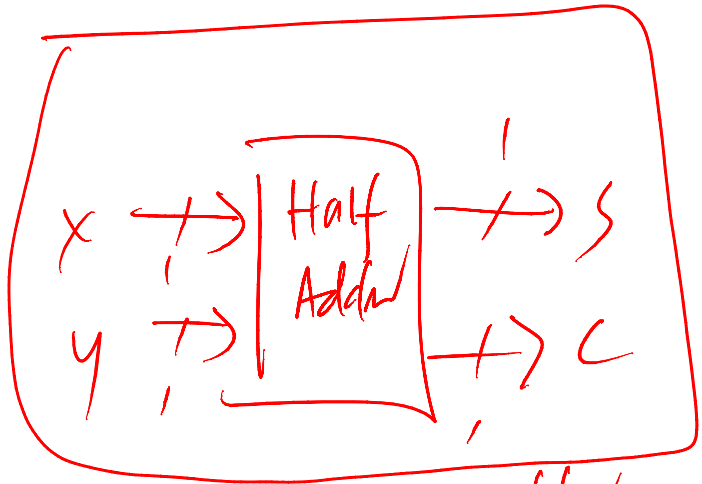
x	y	c	s
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0



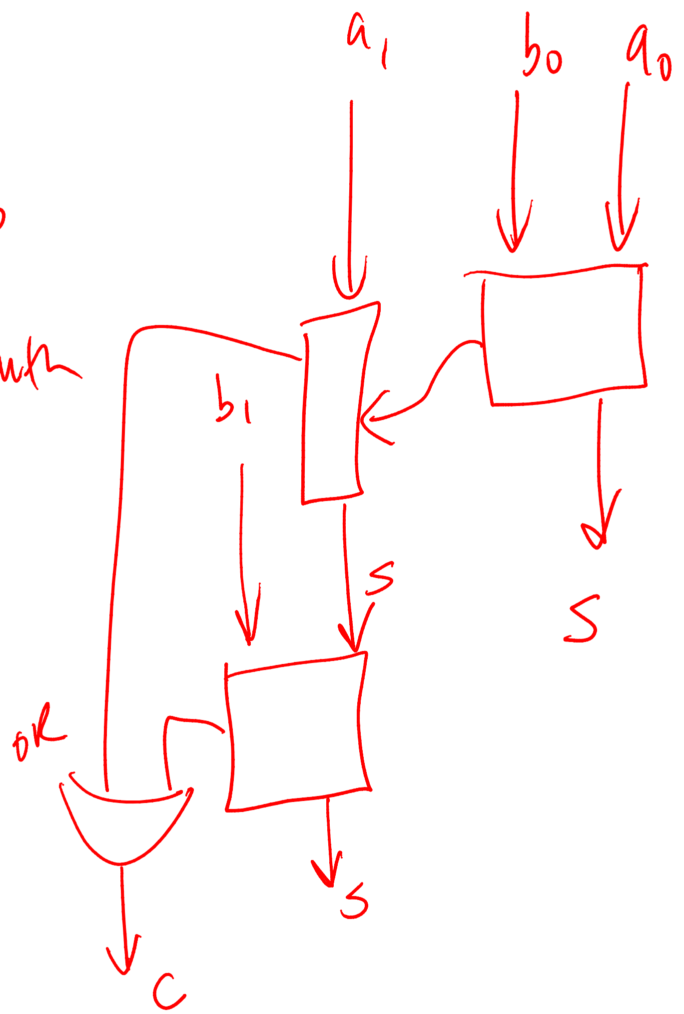
1-bit half adder

$A = a_3 a_2 a_1 a_0$

↑ MSB

$B = b_3 b_2 b_1 b_0$

modify this truth table



2

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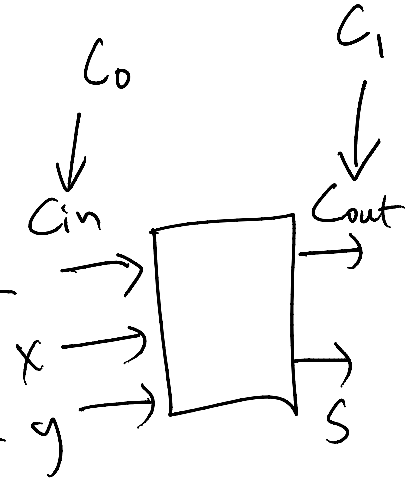
C_{in}	x	y	C_{out}	Sum
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1



$\boxed{C_{out}}$

xy \ C_{in}	0	1
00	0	0
01	0	1
11	1	1
10	0	1

$\boxed{\text{Sum}}$

xy \ C_{in}	0	1
00	0	1
01	1	0
11	0	1
10	1	0

$$C_{out} = C_{in}y + C_{in}x + xy \qquad \text{Sum} = x \oplus y \oplus C_{in}$$

$$\text{Sum} = C_{in}\bar{x}\bar{y} + \bar{C}_{in}\bar{x}y + C_{in}xy + \bar{C}_{in}x\bar{y}$$

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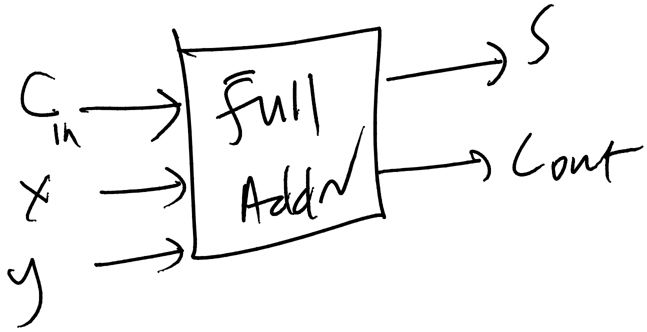
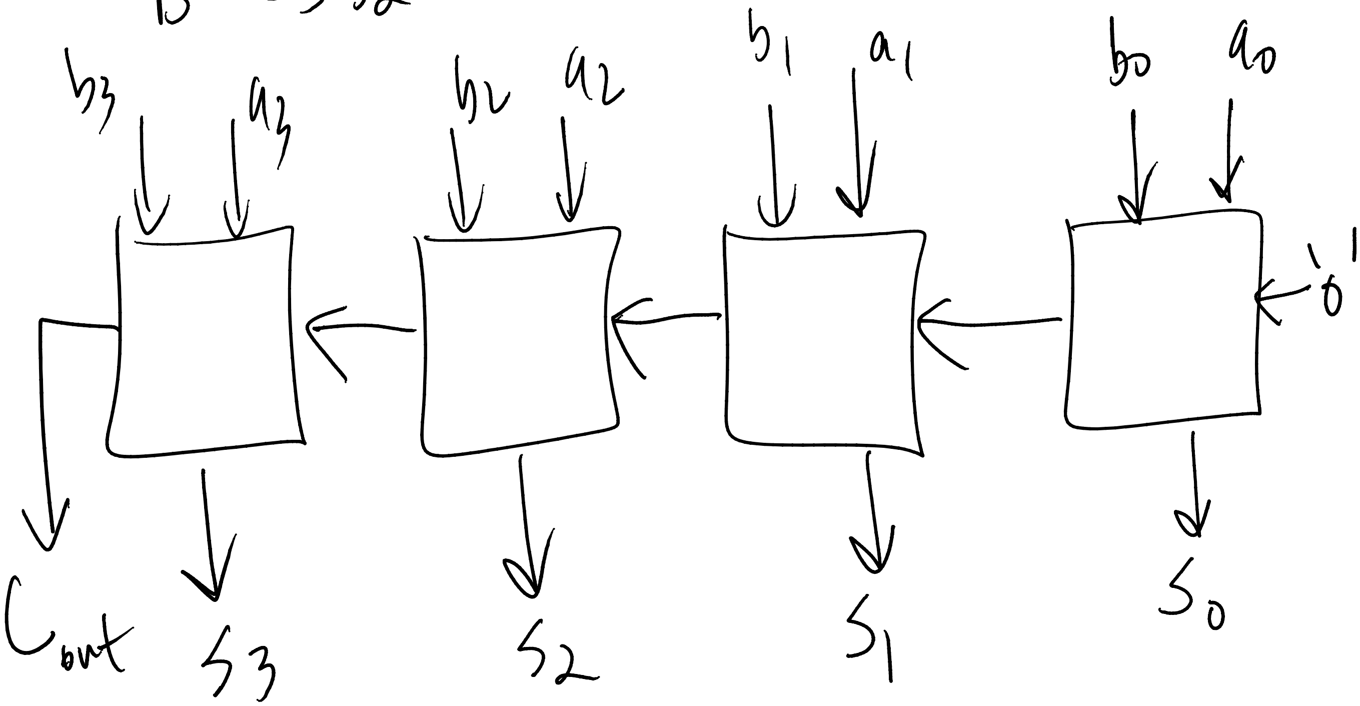


$A = a_3 a_2 a_1 a_0$

$B = b_3 b_2 b_1 b_0$



4-bit adder

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Complement

$-2 \rightarrow \boxed{\text{4-bit}}$

Know the positive version

2

$\boxed{0010}$

1's complement 1101

$\updownarrow$ +1

2's complement 1110

1's complement

$$K = (2^n - 1) - P$$

negative #

positive #

$$K = (2^4 - 1) - 0010$$

$$= \underbrace{(10000 - 1)} - 0010$$

$$= 1111 - 0010$$

$$= 1101$$

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2's Complement

$$K = 2^n - P$$