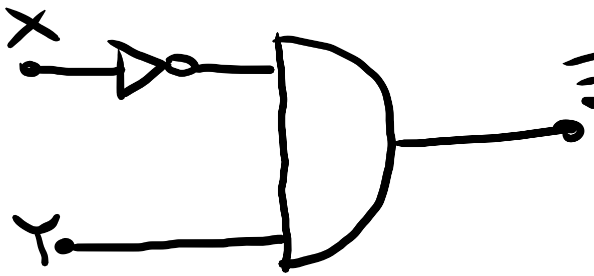
Problem 1 derive the L. Exp $X < Y$

$0 = 0$
$1 = 1$
$10 = 2$
$11 = 3$

X	Y	Z
0	0	0
0	1	1
1	0	0
1	1	0

$\boxed{\text{minterms}}$ $Z = \bar{X} \cdot Y$

"Sum of Prd" "OR of AND"



$Z = X < Y$ ← ①

8 4 2 1

$a = 1011_b = 11$ $1 < 0$ no $a < b$ = False

$b = 0100_b = 4$

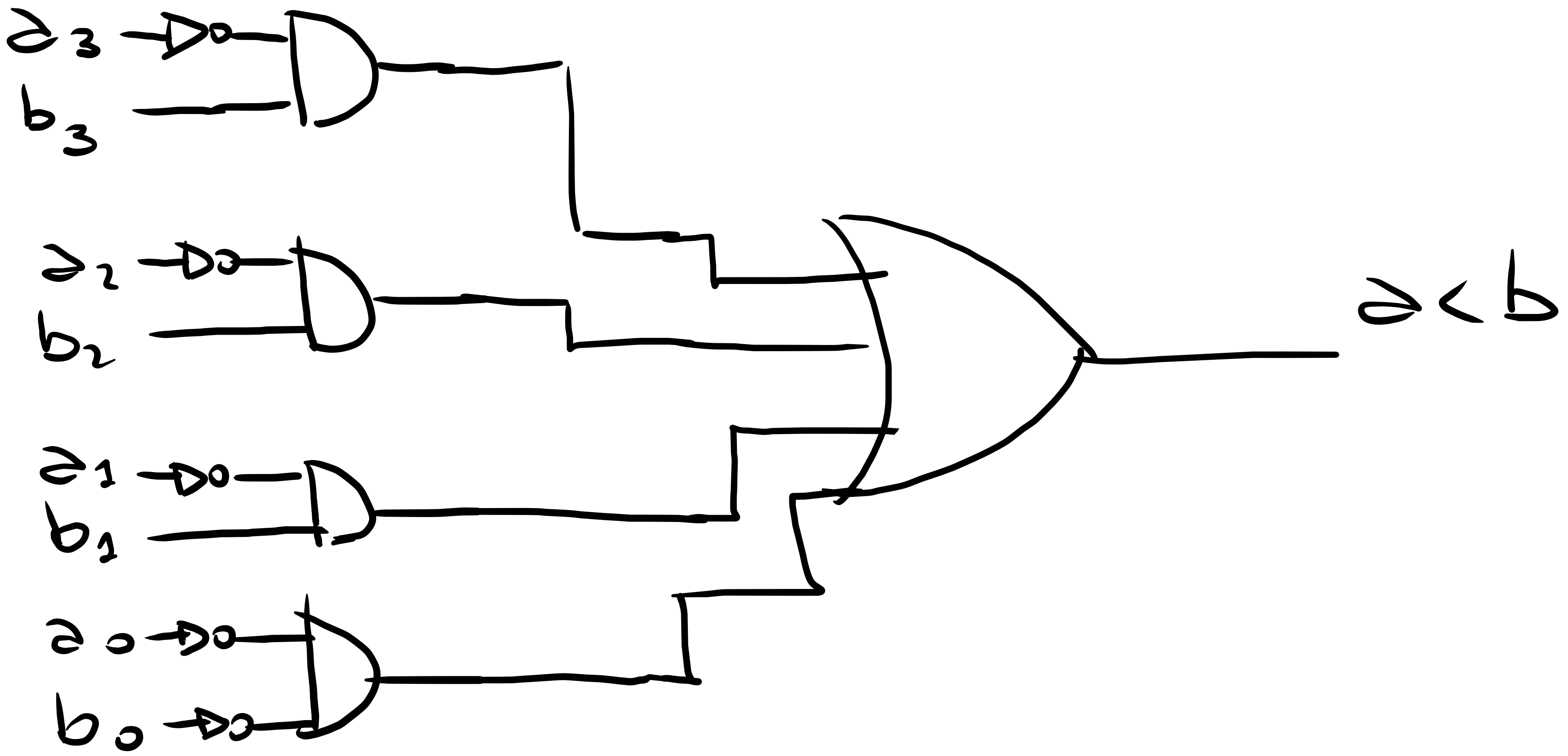
$\underline{\underline{a < b}}$?

$a = 0100$
$b = 0110$

$0 < 0$ no (F)
$1 < 1$ no (F)
$0 < 1$ yes (T)

$a_d = a_3\ a_2\ a_1\ a_0$

$b_d = b_3\ b_2\ b_1\ b_0$



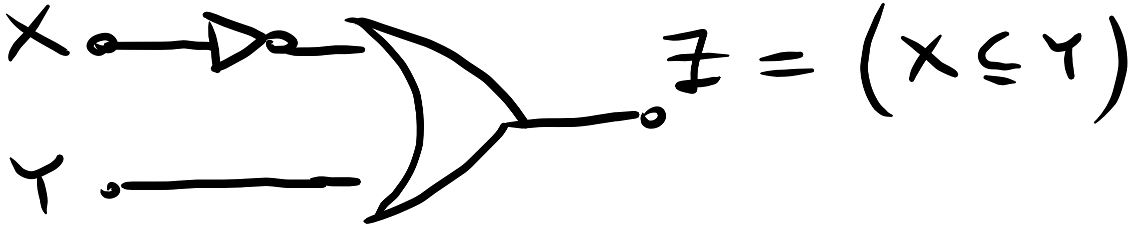
$Z = (X \leq Y)$

②

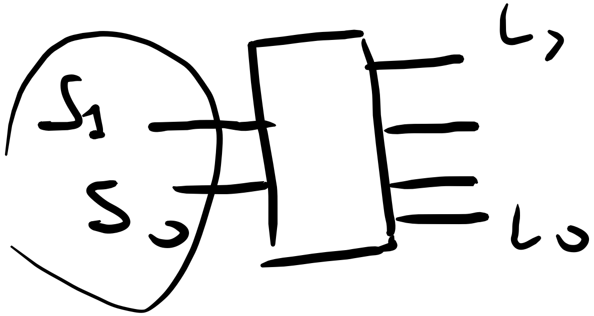
X	Y	Z
0	0	1
0	1	1
1	0	0
1	1	1

$$Z = \bar{X} \cdot \bar{Y} + \bar{X} \cdot Y + X \cdot Y = \bar{X} \cdot (Y + \bar{Y}) + X \cdot Y =$$

$$= \bar{X} + X \cdot Y = \bar{X} + Y$$



Dec. Rep	S_1	S_0	L_3	L_2	L_1	L_0
0	0	0	0	0	0	1
1	0	1	0	0	1	0
2	1	0	0	1	0	0
3	1	1	1	0	0	0



- $L_0 = \bar{S}_1 \cdot \bar{S}_0$
- $L_1 = \bar{S}_1 \cdot S_0$
- $L_2 = S_1 \cdot \bar{S}_0$
- $L_3 = S_1 \cdot S_0$

$Z = X \text{ sum } Y$

			Z	
X	Y	Z_d	C	S
0	0	0	0	0
0	1	1	0	1
1	0	1	0	1
1	1	2	1	0

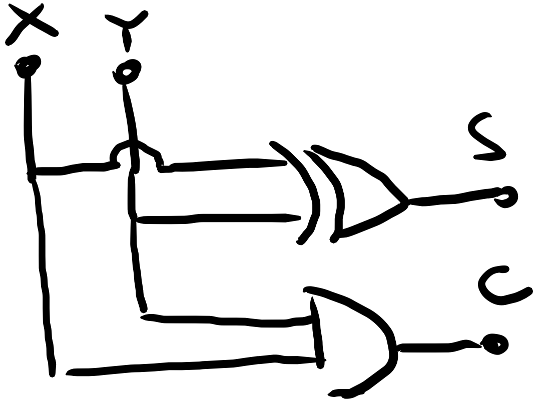
Onebit Full Adder

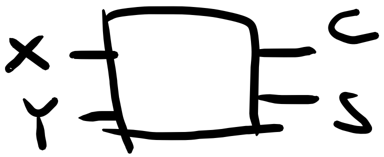
$a = 11_d = 1101_b$

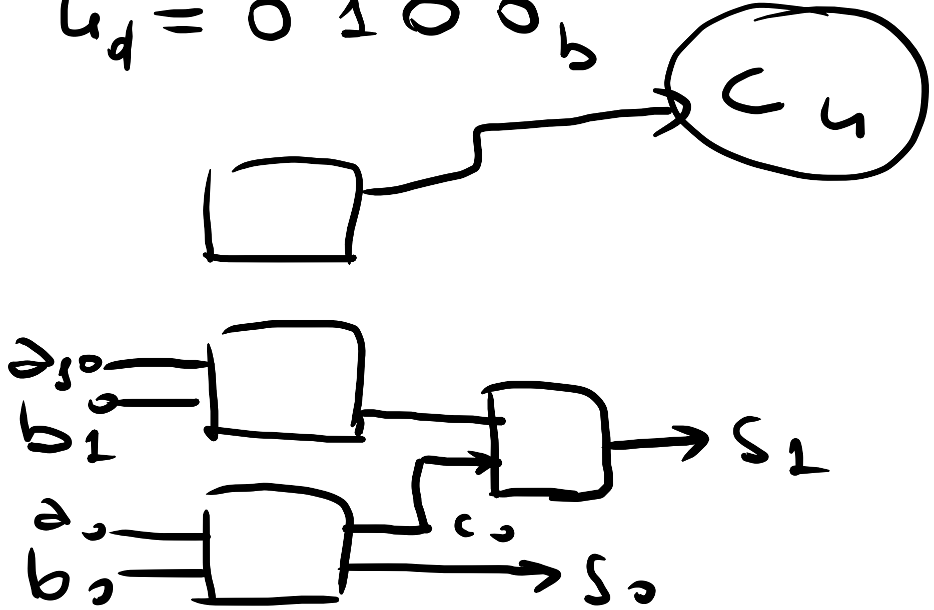
$b = 4_d = 0100_b$

$S = X \oplus Y$

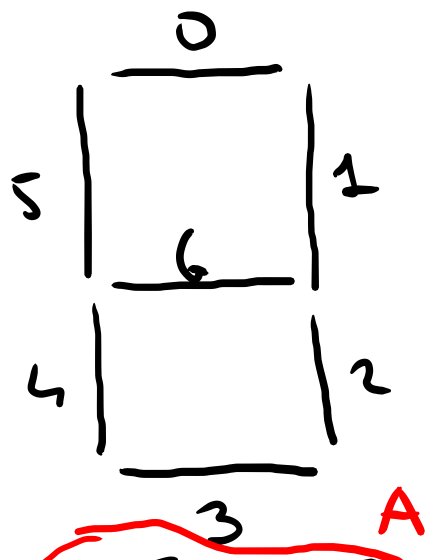
$C = X \cdot Y$







S_i



Hex Dec Rep	L_3	L_2	L_1	L_0	S_0	S_1	S_2	S_3	S_4	S_5	S_6
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1
A	1	0	1	0	1	1	1	0	1	1	1
B	1	0	1	1	0	0	1	1	1	1	1
C	1	1	0	0	1	0	0	1	1	1	0
D	1	1	0	1	0	1	1	1	1	0	1
E	1	1	1	0	1	0	0	1	1	1	1

AND

$$S_0 = \bar{L}_3\bar{L}_2\bar{L}_1\bar{L}_0 +$$
$$+ \bar{L}_3\bar{L}_2 L_1\bar{L}_0 +$$
$$+ \bar{L}_3\bar{L}_2 L_1 L_0 +$$
$$+ \bar{L}_3 L_2 \bar{L}_1 L_0 +$$

MINTERM

minterm

$$Z = XY + \bar{X}Y$$ minterms

$$\bar{Z} = \overline{XY + \bar{X}Y}$$

$$\bar{Z} = \overline{XY} \cdot \overline{\bar{X}Y} = (\bar{X} + \bar{Y}) \cdot (X + \bar{Y})$$ Prod. of Sums

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