

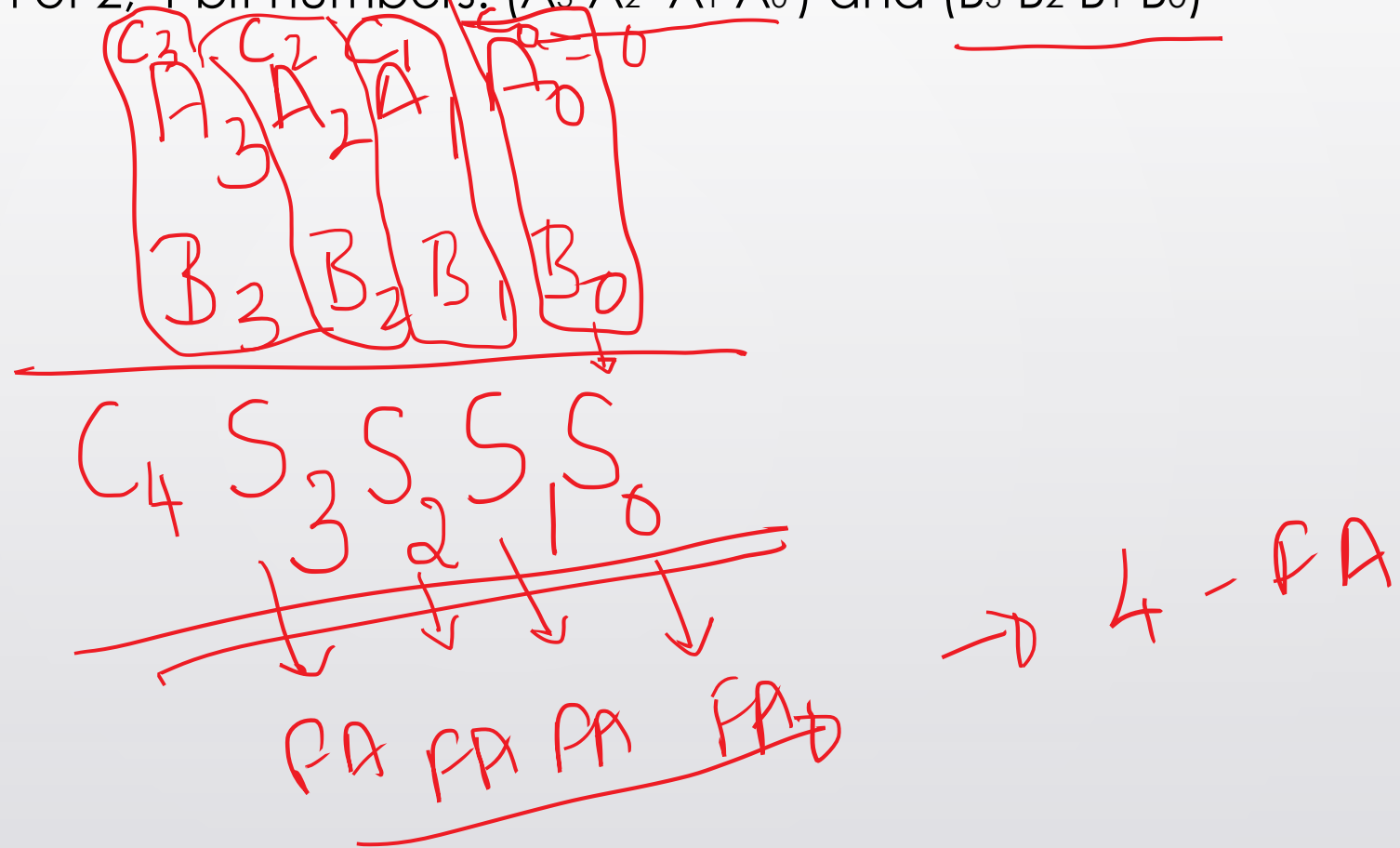


# Binary adders and subtractors

- Half adder, full adder, parallel adder
- Half subtractor , full subtractor, parallel subtractor
- Subtraction using complements, parallel adder/subtractor
- Carry Look ahead adder, Decimal adder

# 4-bit Parallel adder using FA blocks

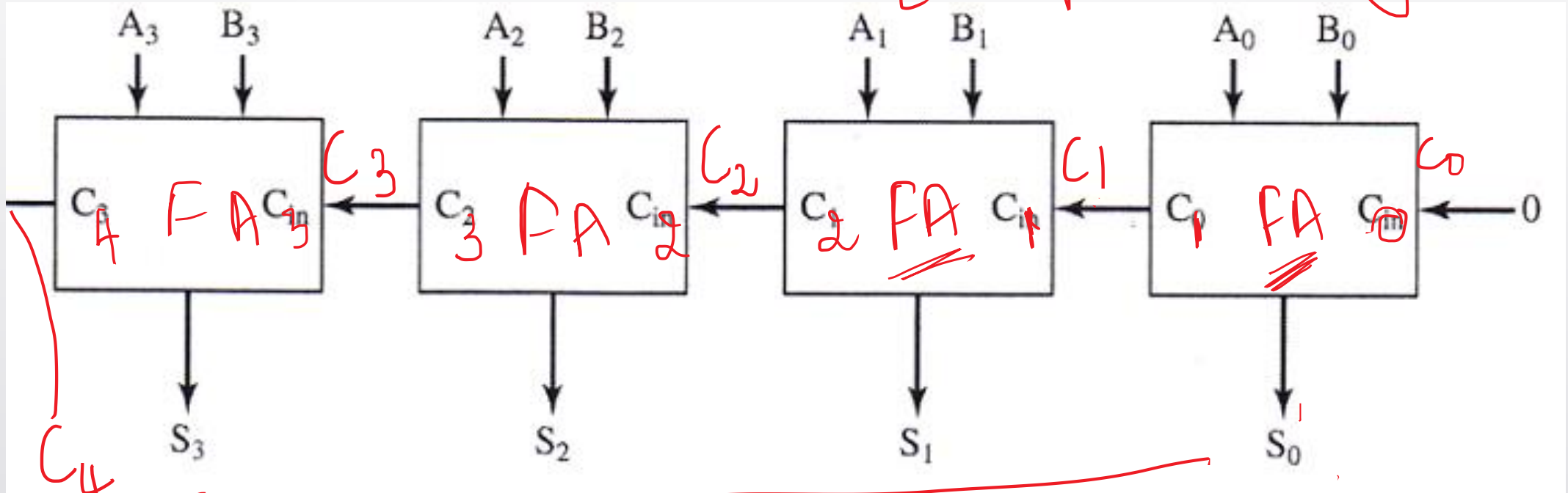
- Consider addition of 2, 4-bit numbers:  $(A_3 A_2 A_1 A_0)$  and  $(B_3 B_2 B_1 B_0)$



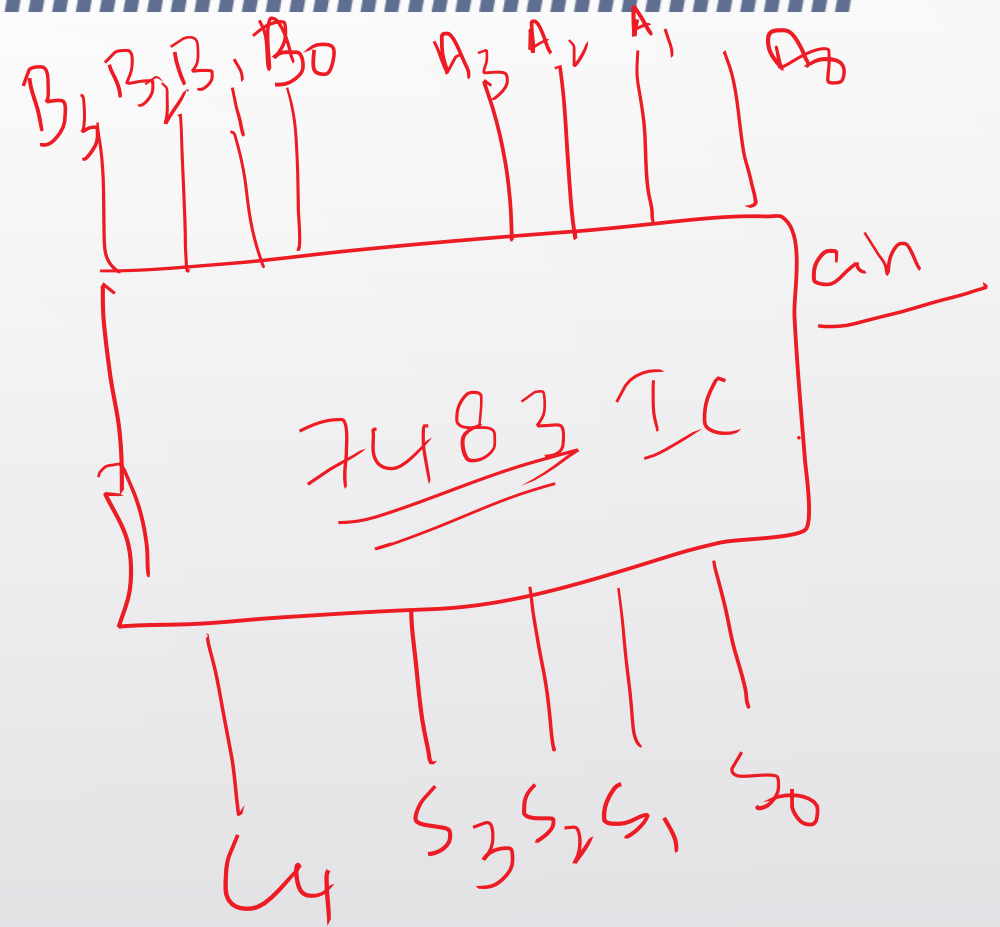
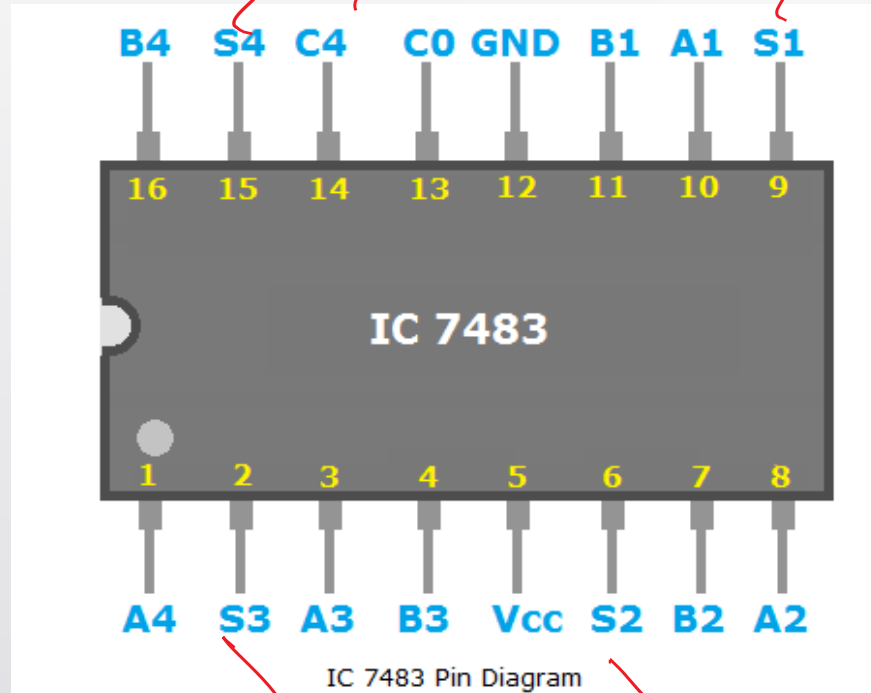
# 4-bit parallel adder

Also called as Carry Propagation Adder (CPA)

[Ripple Carry Adder]

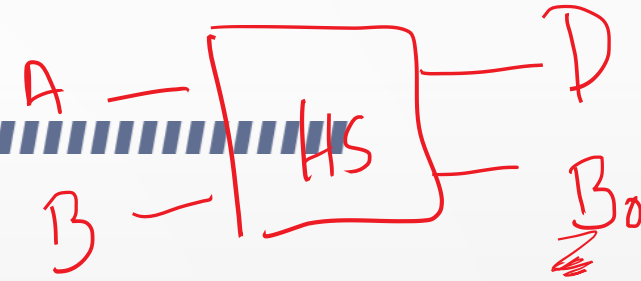


# 7483 IC : 4-BIT PARALLEL ADDER



# Half subtractor

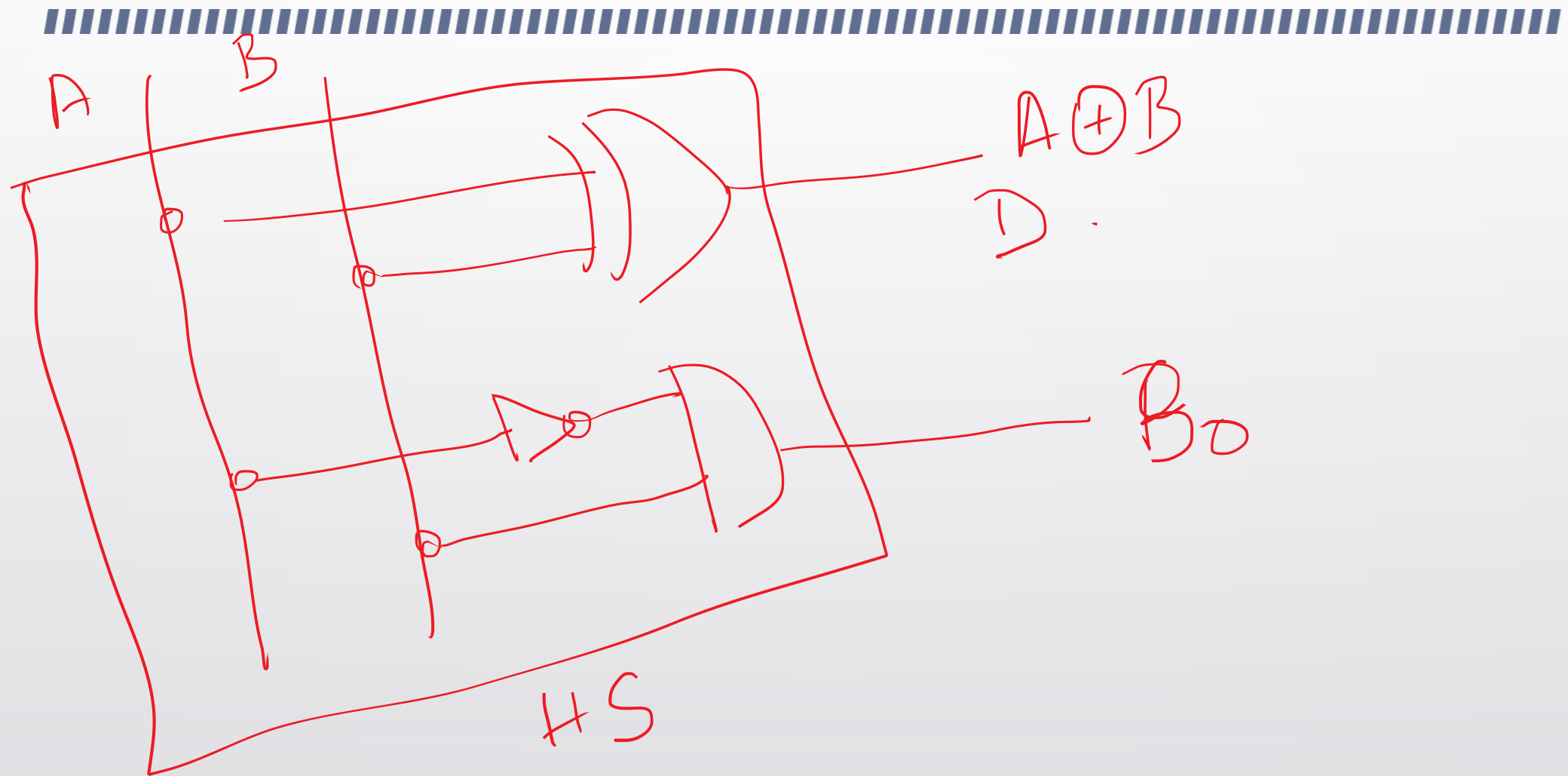
- Write the truth table and circuit for half subtractor



A	<del>B</del>	D	B <sub>0</sub>
0	0	0	0
0	1	1	<del>1</del>
1	0	1	0
1	1	0	0

$$D = \overline{A}B + A\overline{B}$$
$$= \underline{\underline{A \oplus B}}$$

$$B_0 = \underline{\underline{\overline{A}B}}$$





# Full subtractor

DIFFERENCE (D) = X-Y-Z, Borrow (B)

X	Y	Z	D	B
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

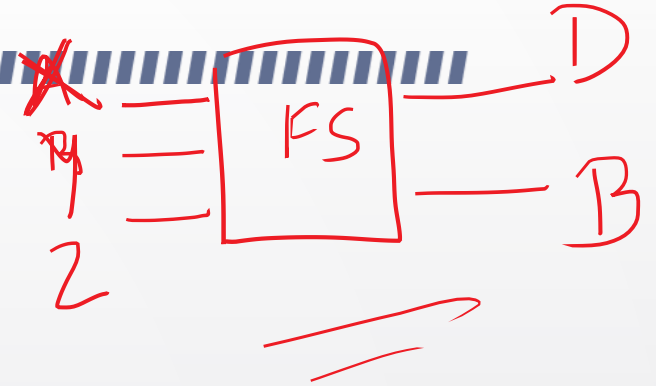
Expressions for D and B:

$D = \bar{X} \bar{Y} Z + \bar{X} Y \bar{Z} + X \bar{Y} \bar{Z} + X Y Z$

00	01	11	10
0	1	0	1
1	0	1	0

$$D = \bar{X} \bar{Y} Z + \bar{X} Y \bar{Z} + X \bar{Y} \bar{Z} + X Y Z$$

$$= \underline{\underline{X \oplus Y \oplus Z}}$$



x \ yz	00	01	11	10
	0	1	1	1
1	0	0	1	0

$$B = \bar{x}z + yz + \bar{x}y$$

$$\begin{aligned}
 B &= \bar{x}\bar{y}z + \bar{x}yz + \bar{x}y\bar{z} + x y z \\
 &= \bar{x}y [z + \bar{z}] + z [\bar{x}\bar{y} + xy] \\
 &= \bar{x}y + z(x \oplus y)
 \end{aligned}$$



# FS circuit



- Draw the circuit for FS using
- (i) basic logic gates only ✓
- (ii) XOR and basic logic gates ✓

*Draw*

# Full subtractor using 2 HS s and one external gate

