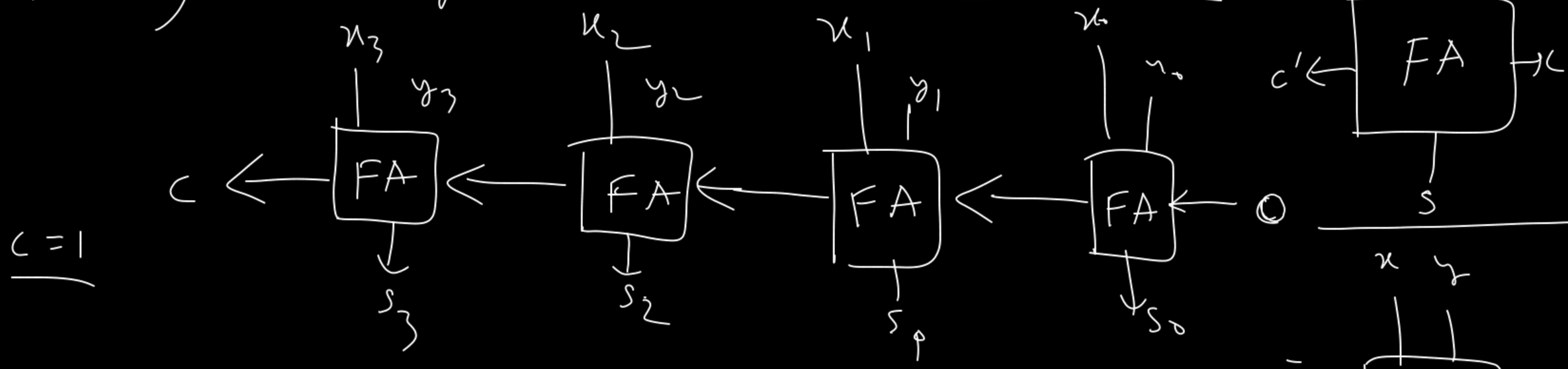
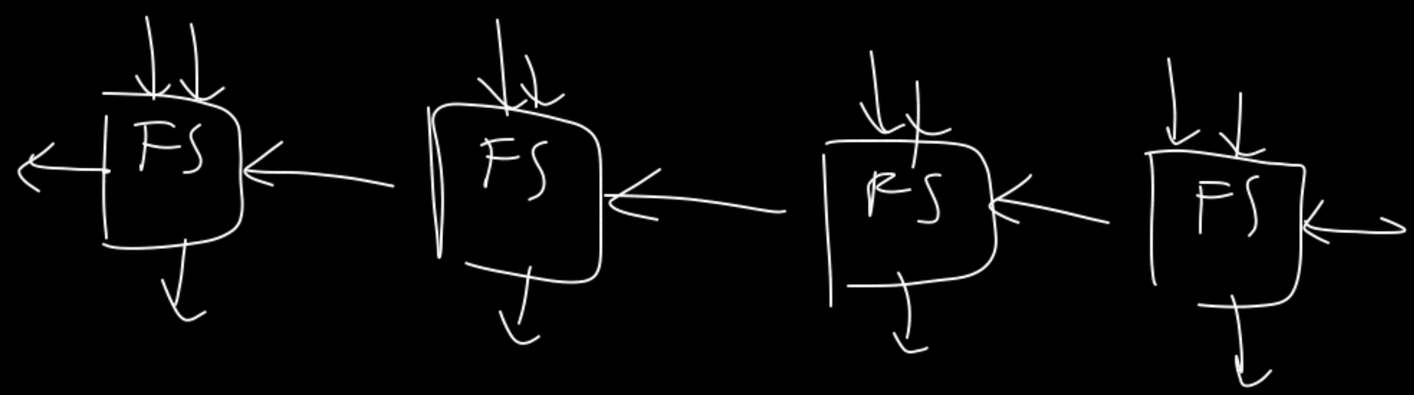
Binary Unsigned Number Addition



Substraction:

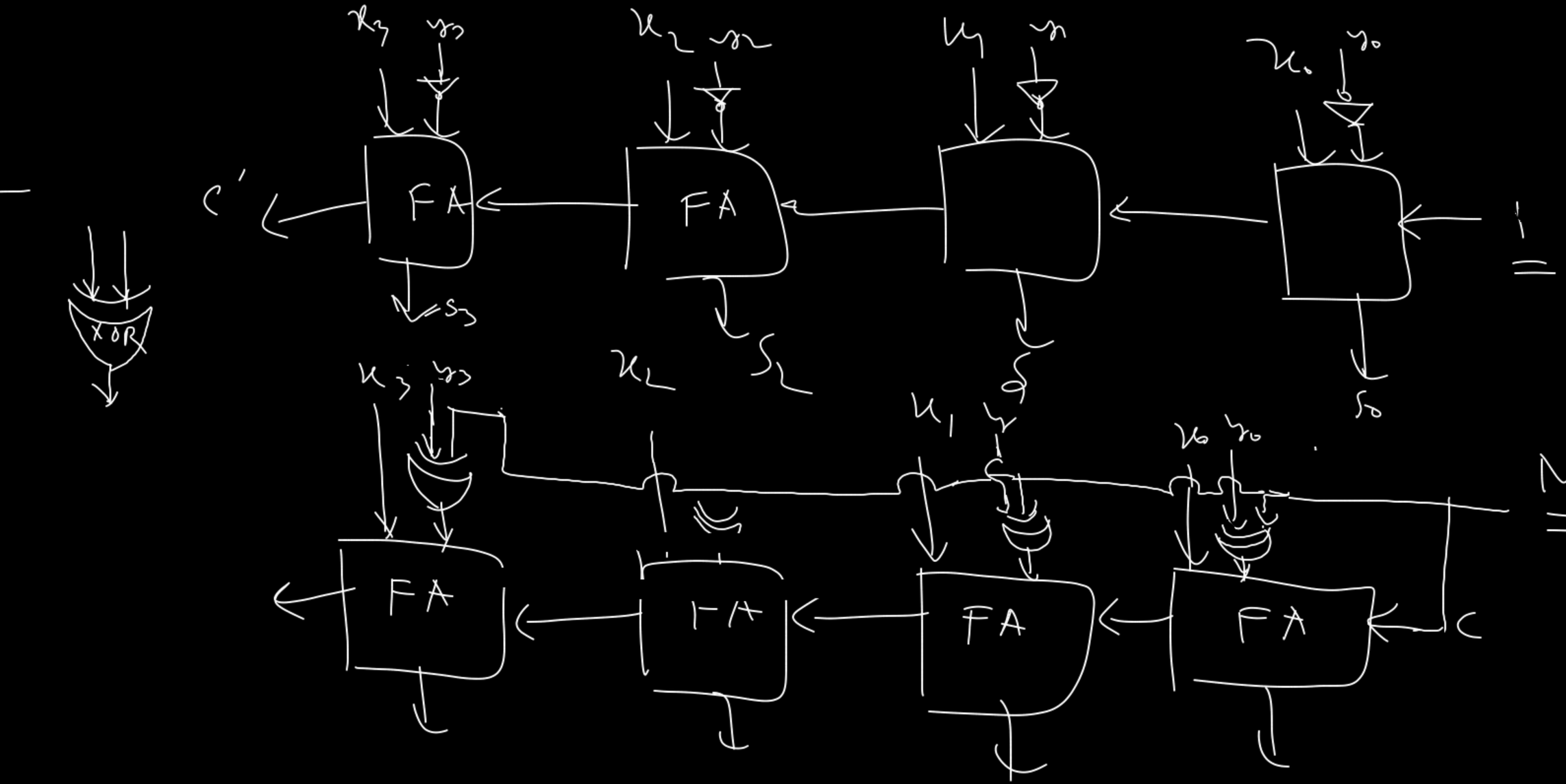


$x - y$

$x_3 x_2 x_1 x_0 \quad y_3 y_2 y_1 y_0$

Unsigned Integer

XOR	M	y	z
	0	0	0
	1	1	0
	1	0	1
	0	1	1



How to detect Underflow? Homework

c 0
x 1
y

111 000
1

0100
1000

0111
1000

01110
0 — 11

Simply for x - y   x < y → overflow occurs

x, y	0	1

x_3 x_2 x_1 x_0
y_3 y_2 y_1 y_0

Underflow 1 1 0 1
1 1 1 0

Signed Version

① $x + y$ (±, ±) $(x)-(y)$ (±, ±)

Sign bit: x_3 y_3 ↓ ↓

absolute bit → 0 → ; 1 → 2's complement

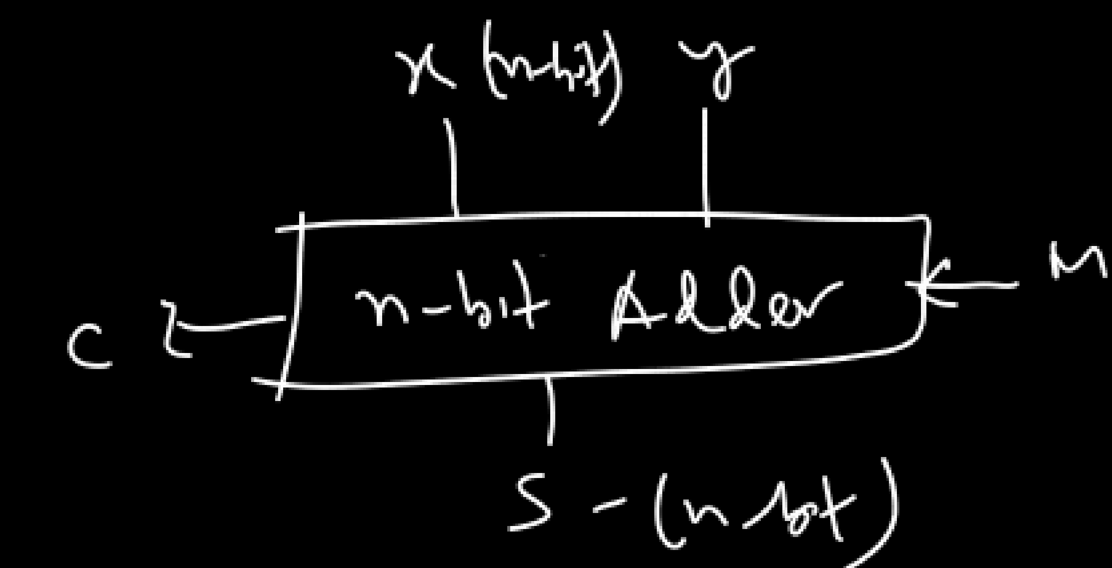
Addition / Subtraction mode ↓ 1

Q: if we use the same circuit, will it work?

$$7 - (-7) = \bar{7} + 2$$

* Homework! How it gives correct?
  * iPen → Go to all posible Cases.

Multiplication: Unsigned Integer.



01
1010

Large memory
① x, s

0000 1001 x →
1010 y →

0000
1 001
0 0 0 0
0 1 0 1

100100 x
0010 →

s
10010

Add (x, y) → s, c

x s = 0

for each i = 0 to n-1
— if y[0] == 1
— s = s + x
— y = y >> 1
— x = x << 1

Signed Version

① Take sign-bit
② Convert to the
③ Use Unsigned Multiplier