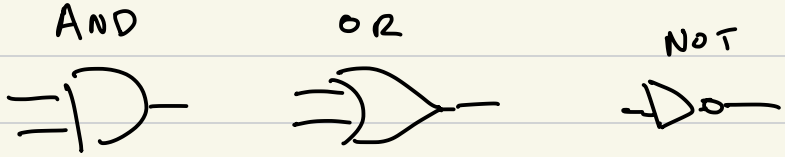
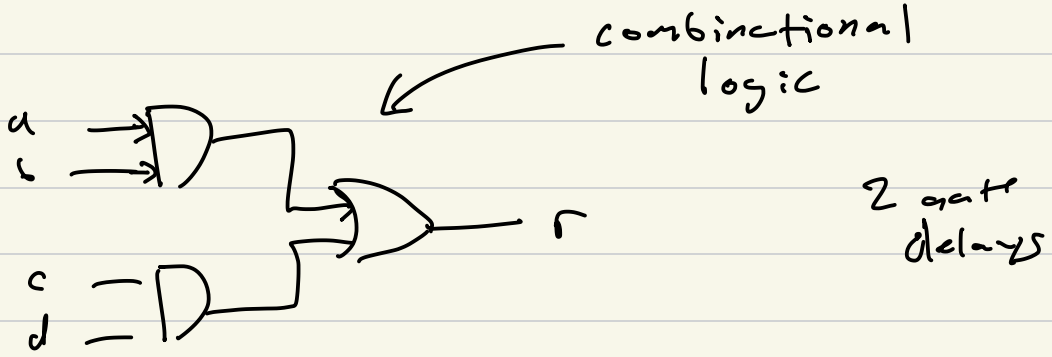
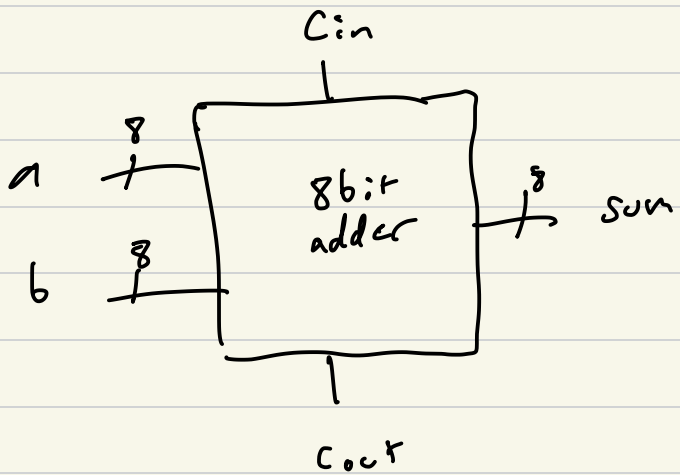
CS315-02 Combinational Logic Adder



sum-of-products



Goal:



Sum-of-products

A new function

3-bit number $n_2 n_1 n_0$ (bits)

Two 1 bit outputs: even odd

Goal: determine if number of "1" bits is even or odd

1 1 0	even
1 0 1	even
1 0 0	odd
1 1 1	odd

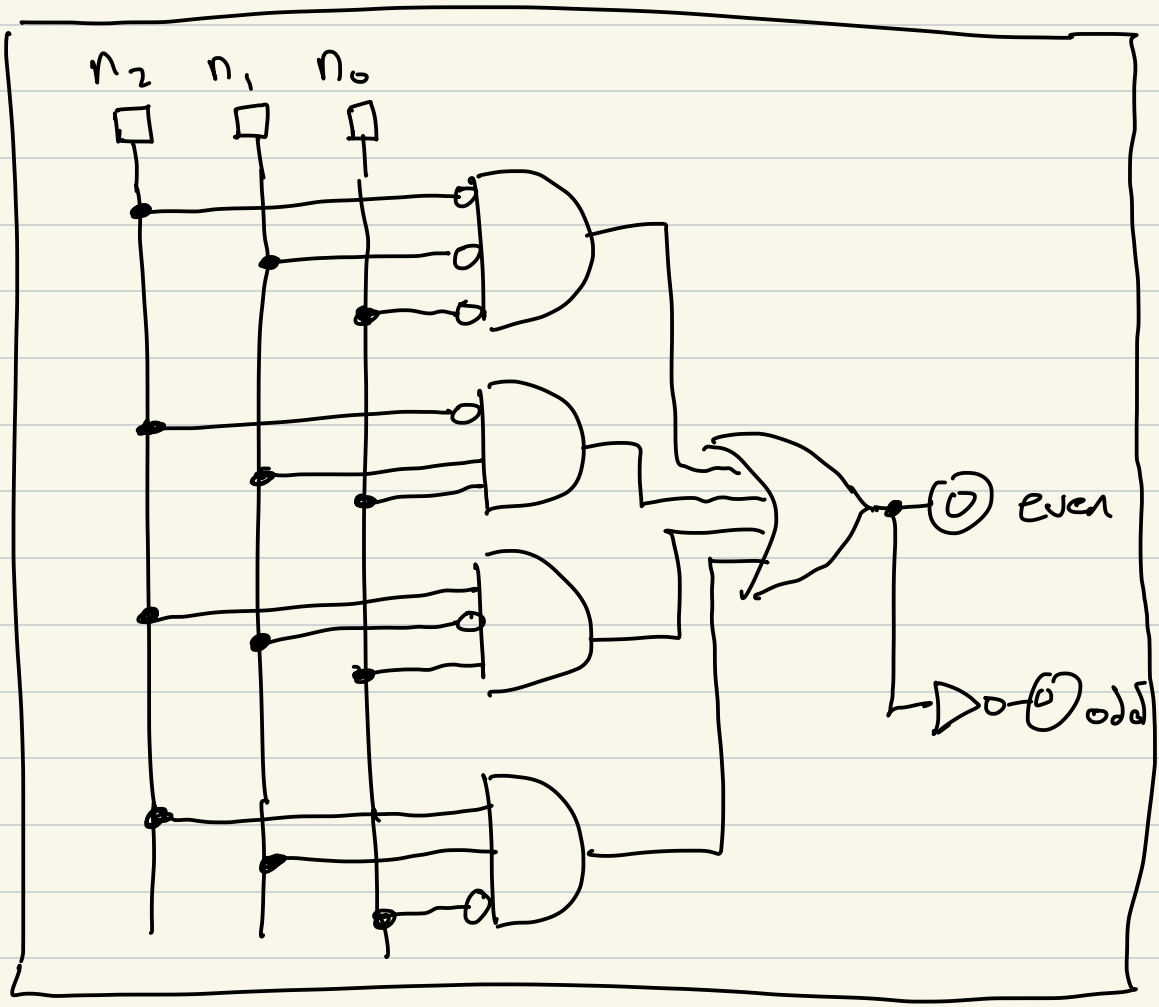
sum-of-product

1) truth table
2) identify rows with output of 1
3) form SOP equation

	n_2	n_1	n_0	even	odd
	0	0	0	1	0
	0	0	1	0	1
	0	1	0	0	1
2	0	1	1	1	0
	1	0	0	0	1
3	1	0	1	1	0
4	1	1	0	1	0
	1	1	1	0	1

$$even = (\bar{n}_2 \cdot \bar{n}_1 \cdot \bar{n}_0) + (\bar{n}_2 \cdot n_1 \cdot n_0) + (n_2 \cdot \bar{n}_1 \cdot n_0) + (n_2 \cdot n_1 \cdot \bar{n}_0)$$

$$odd = \overline{even}$$

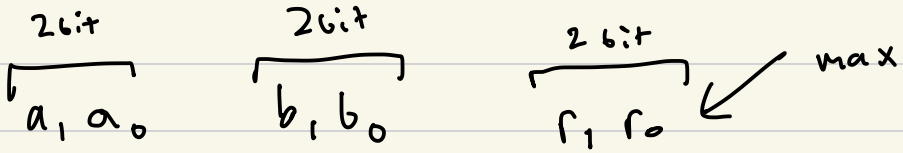


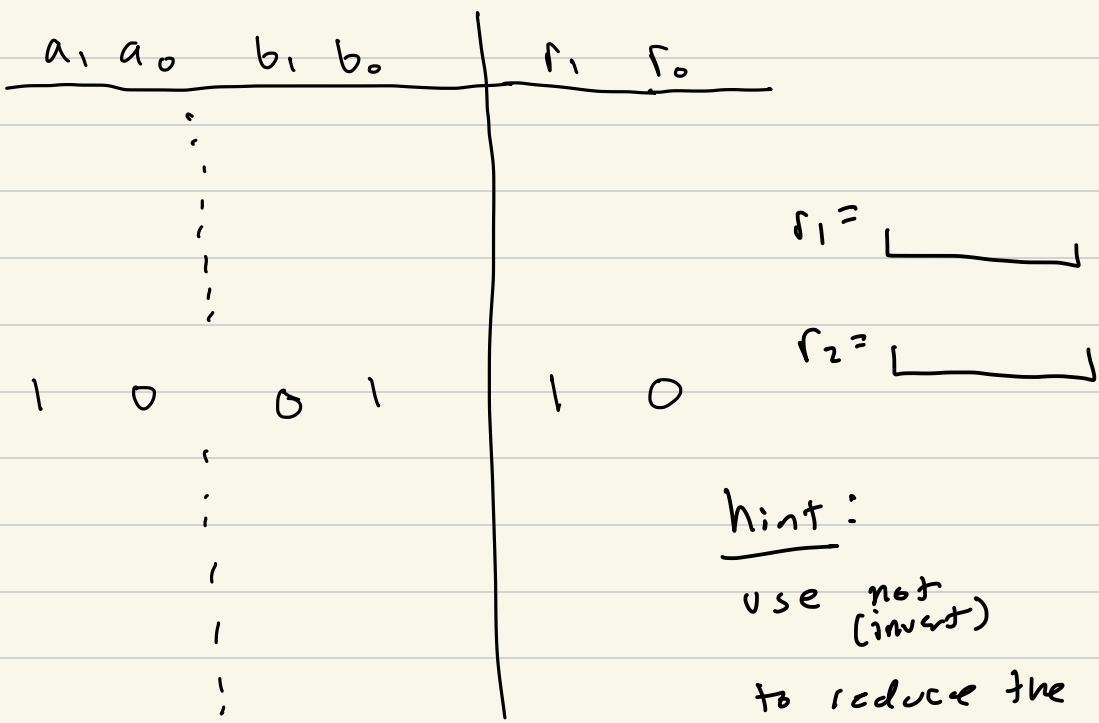
Digital Components

even-odd-bits

even-odd-multi:

Lab04 Part2 Max2



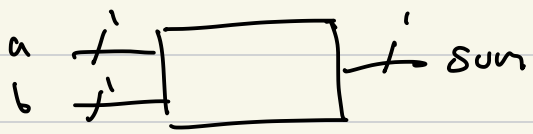


hint:

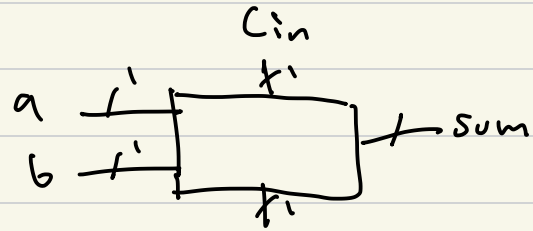
use not (invert)

to reduce the number of product terms

1 bit Adder

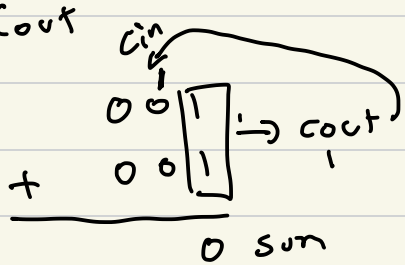


1 bit half adder



1 bit full adder

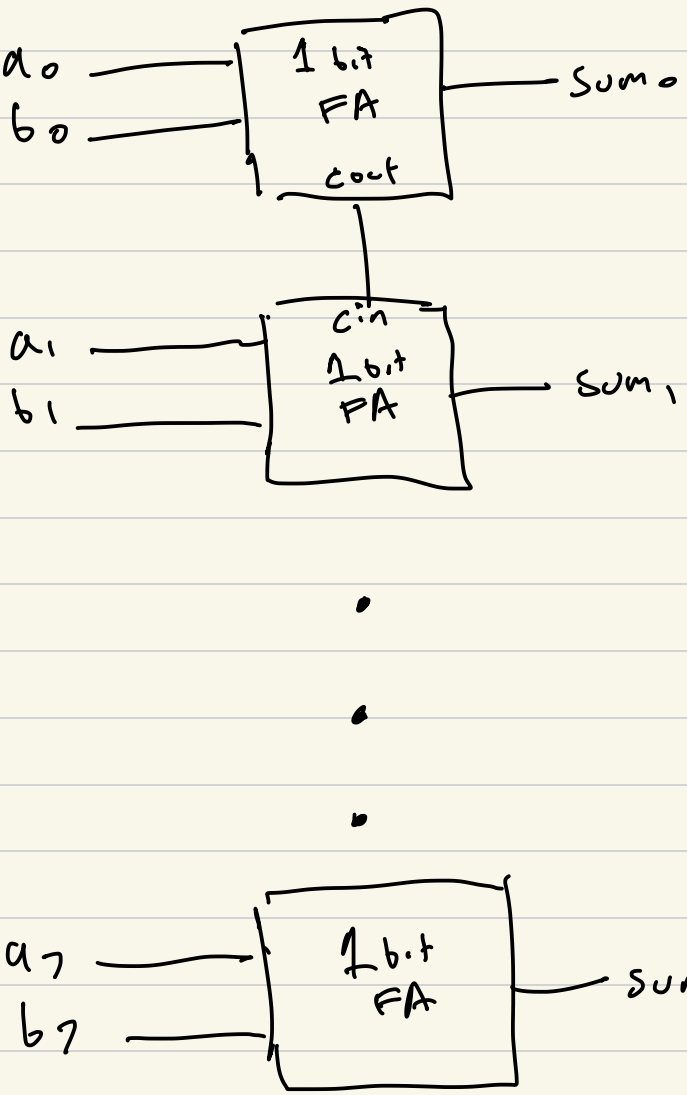
Part 3 truth table



1 bit full adder

8 bit ripple carry adder

FA = full adder



Cin

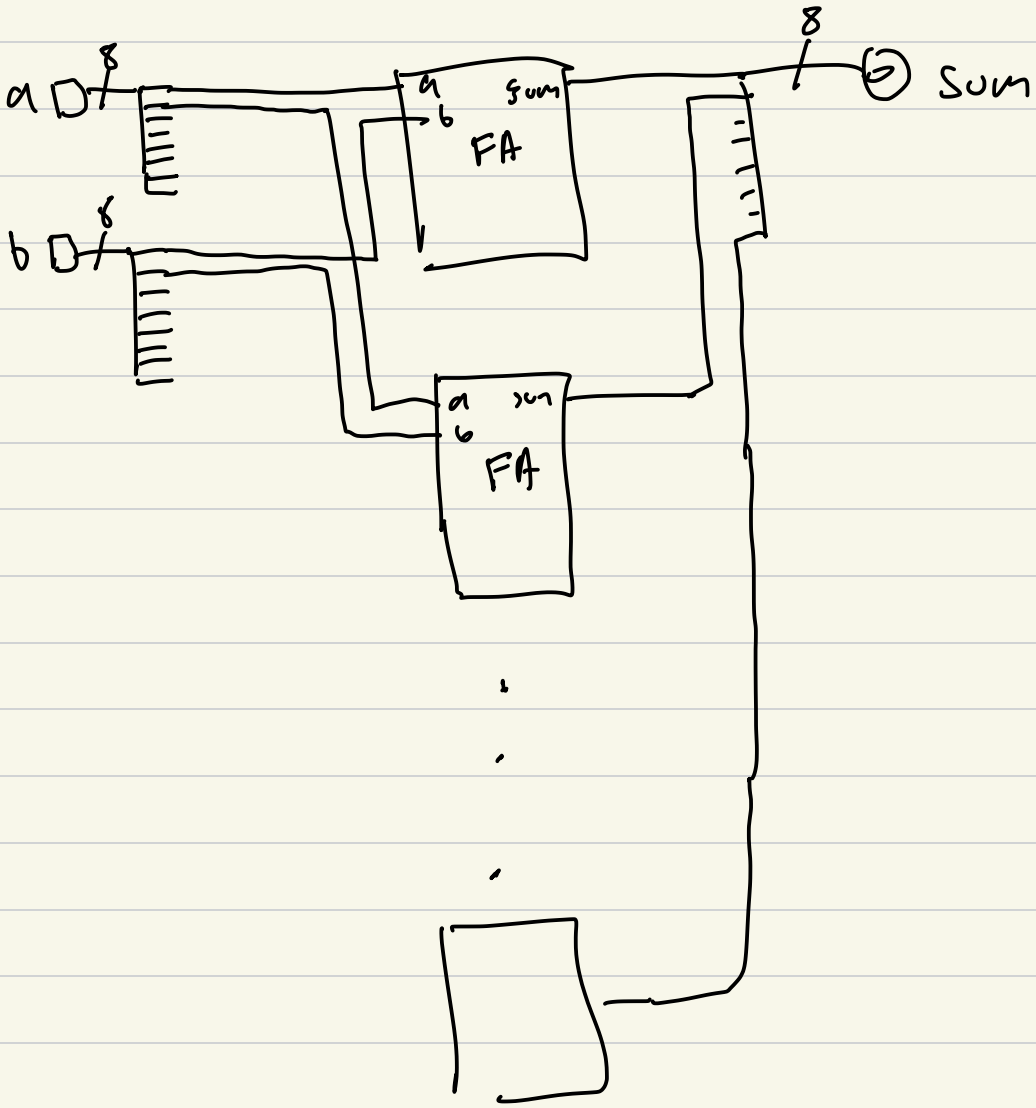
$a_7 a_6 a_5 a_4 a_3 a_2 a_1 a_0 \; b_7 b_6 b_5 \cdots$

How many inputs?

17 bit

2^{17}

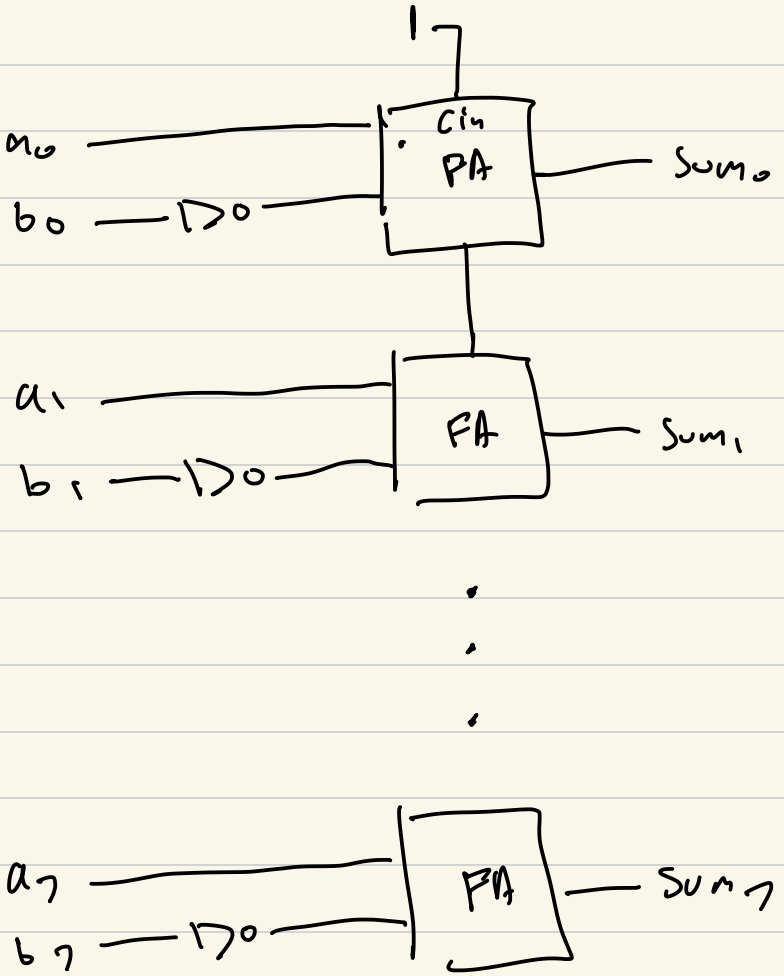
8 bit Ripple Carry Adder



Subtraction

$A - B == A + (-B)$

invert add 1

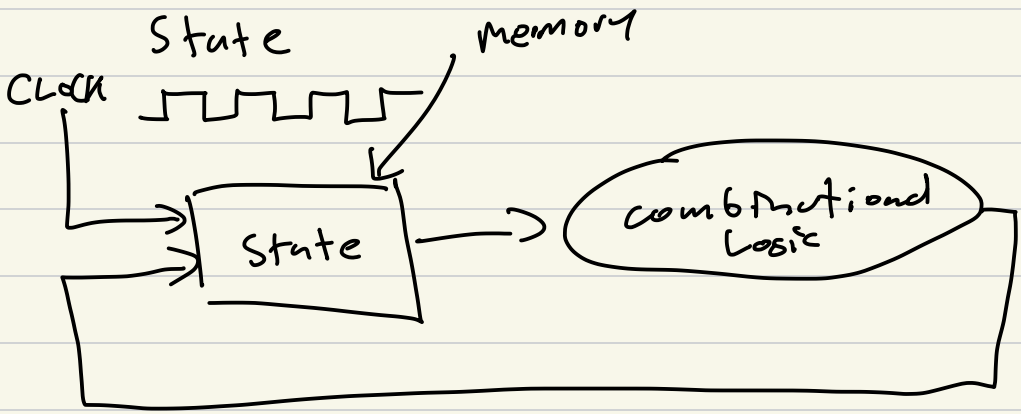


Combinational Logic

components

multiplexor
decoder

Sequential Logic



processor