Carry Save Adder (1A)

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Please send corrections (or suggestions) to youngwlim@hotmail.com.

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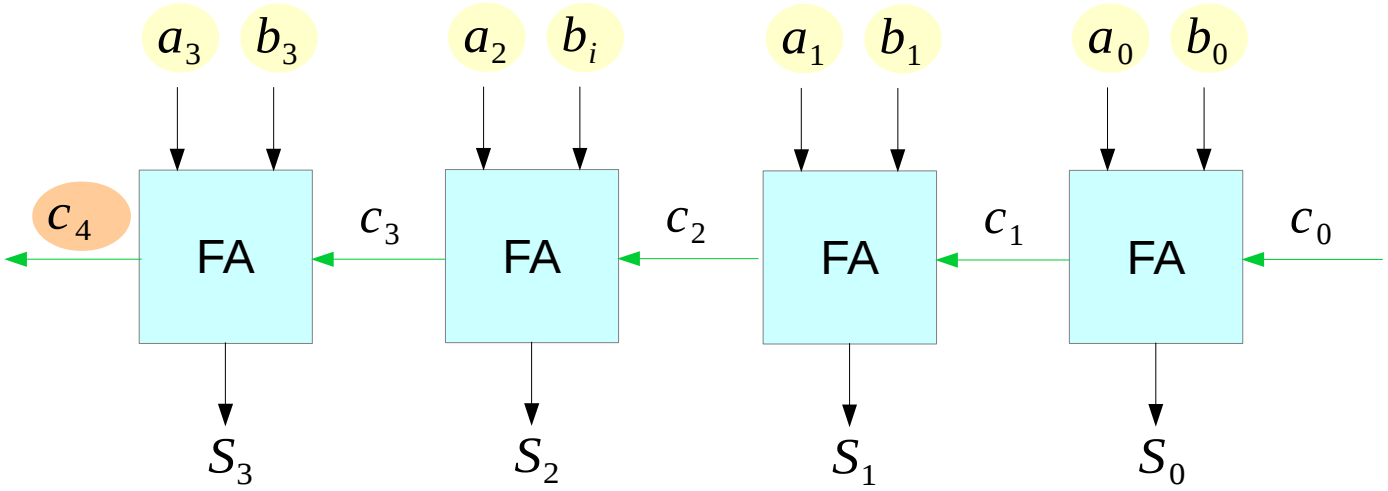
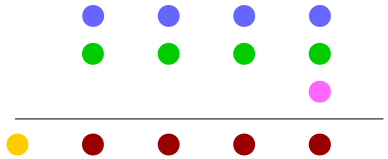
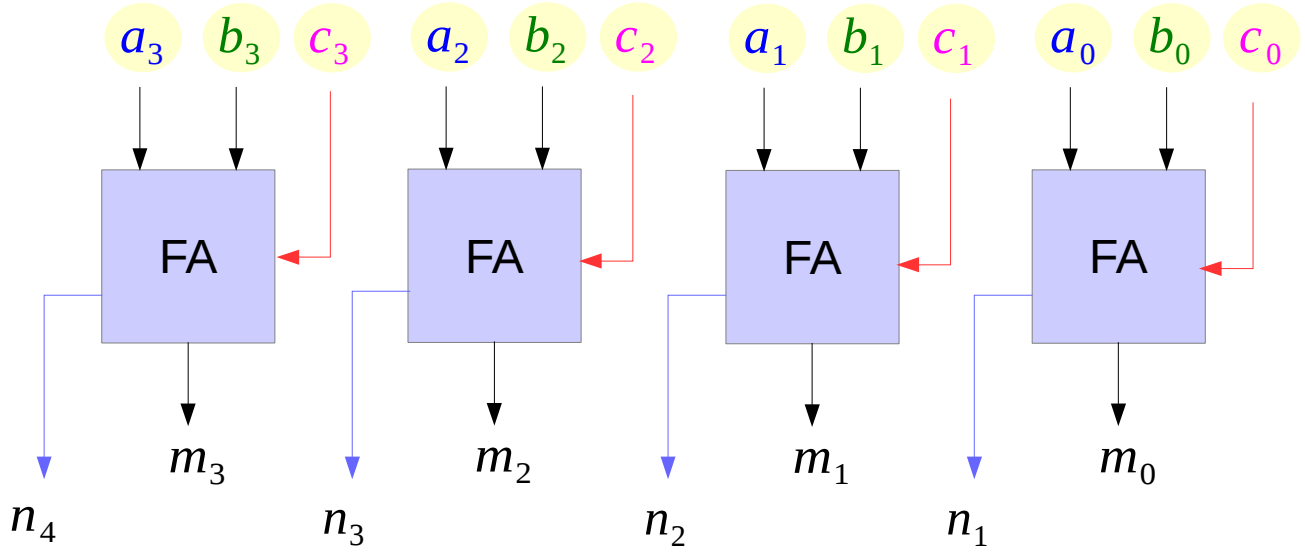
Multi-operand Adders



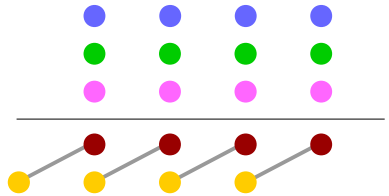
Ripple Carry Adder



Carry Propagate Adder

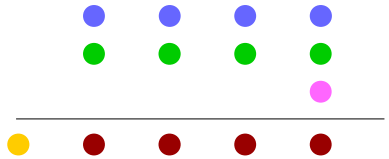


Carry Save Adder



(3; 2) Counter

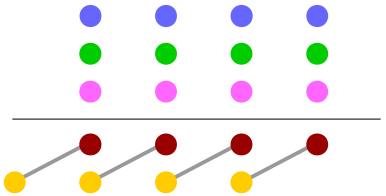
Ripple Carry Adder



Add **two** numbers with carry in

One number with Carry out

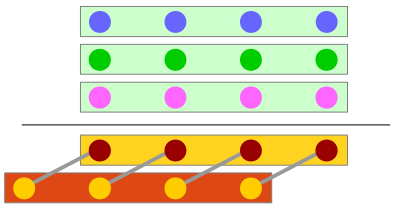
Carry Save Adder



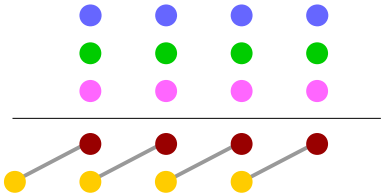
Add **three** numbers without carry in

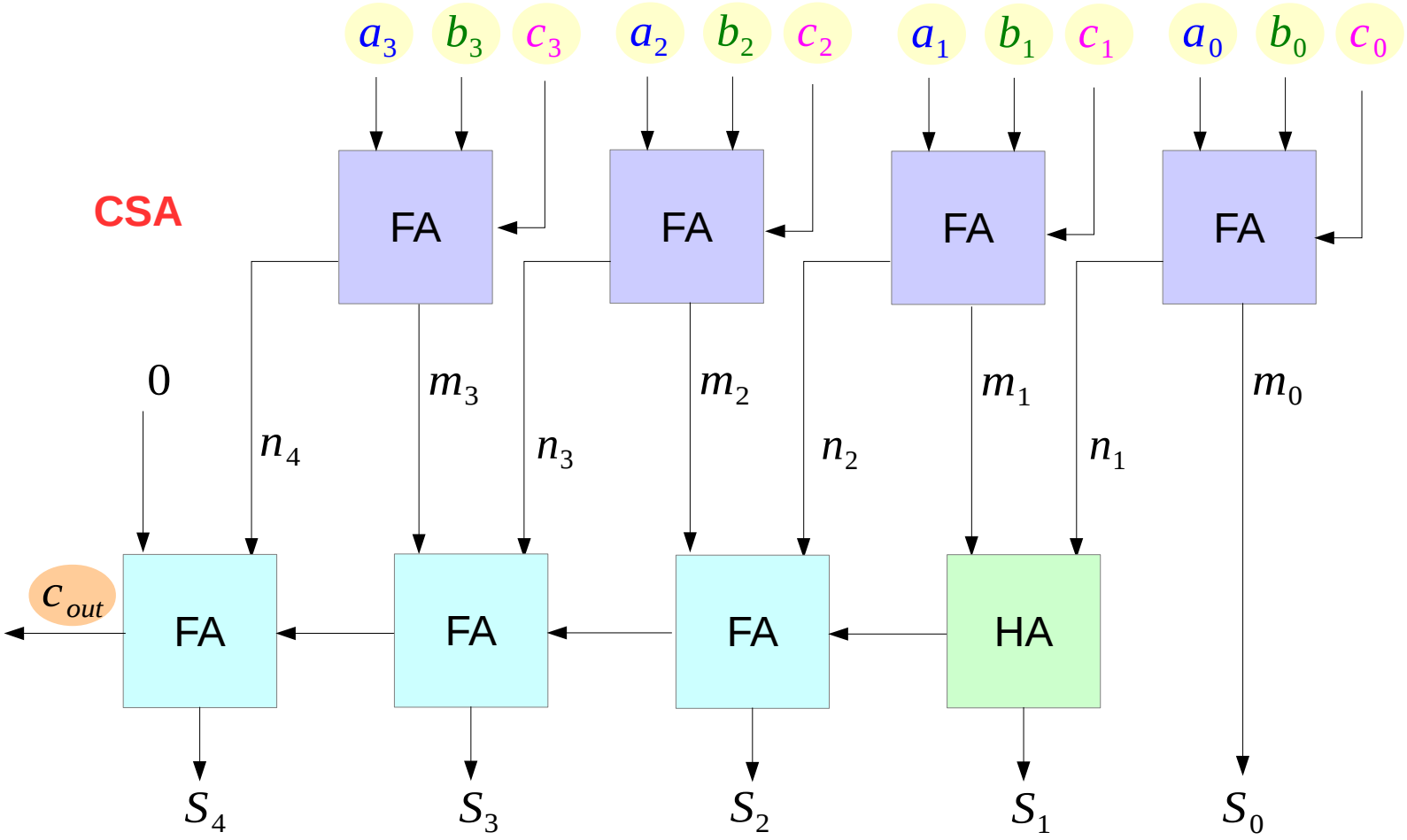
Two numbers

(3; 2) counter
3-to-2 reduction



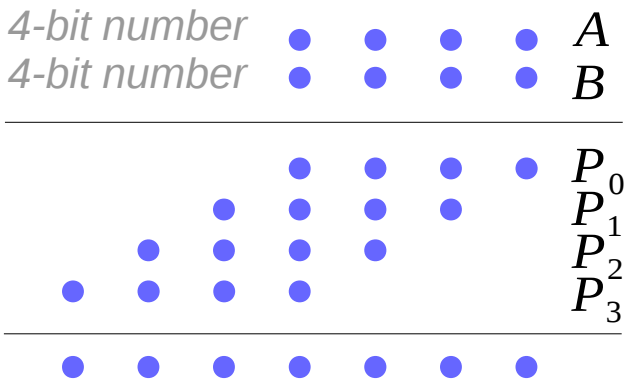
CSA + RCA



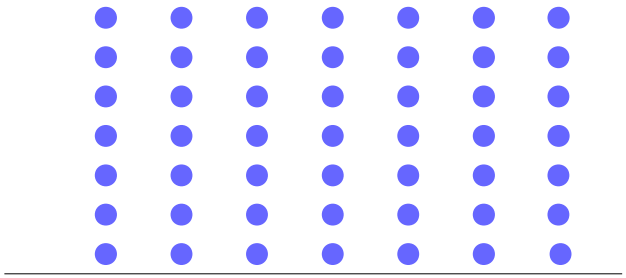

a_3 b_3 c_3 a_2 b_2 c_2 a_1 b_1 c_1 a_0 b_0 c_0
CSA
FA FA FA FA
0
m_3 m_2 m_1 m_0
n_4 n_3 n_2 n_1
c_{out}
CPA
(RCA, etc.)
FA FA FA HA
S_4 S_3 S_2 S_1 S_0

Multi-operand Addition Examples (1)

4-bit number multiplication



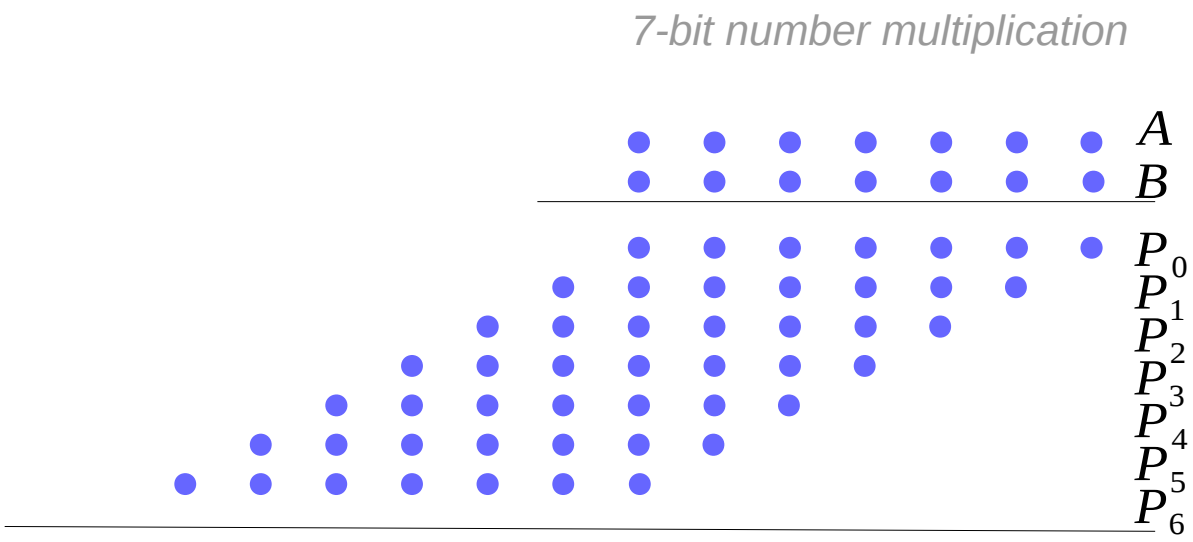
seven 7-bit number addition



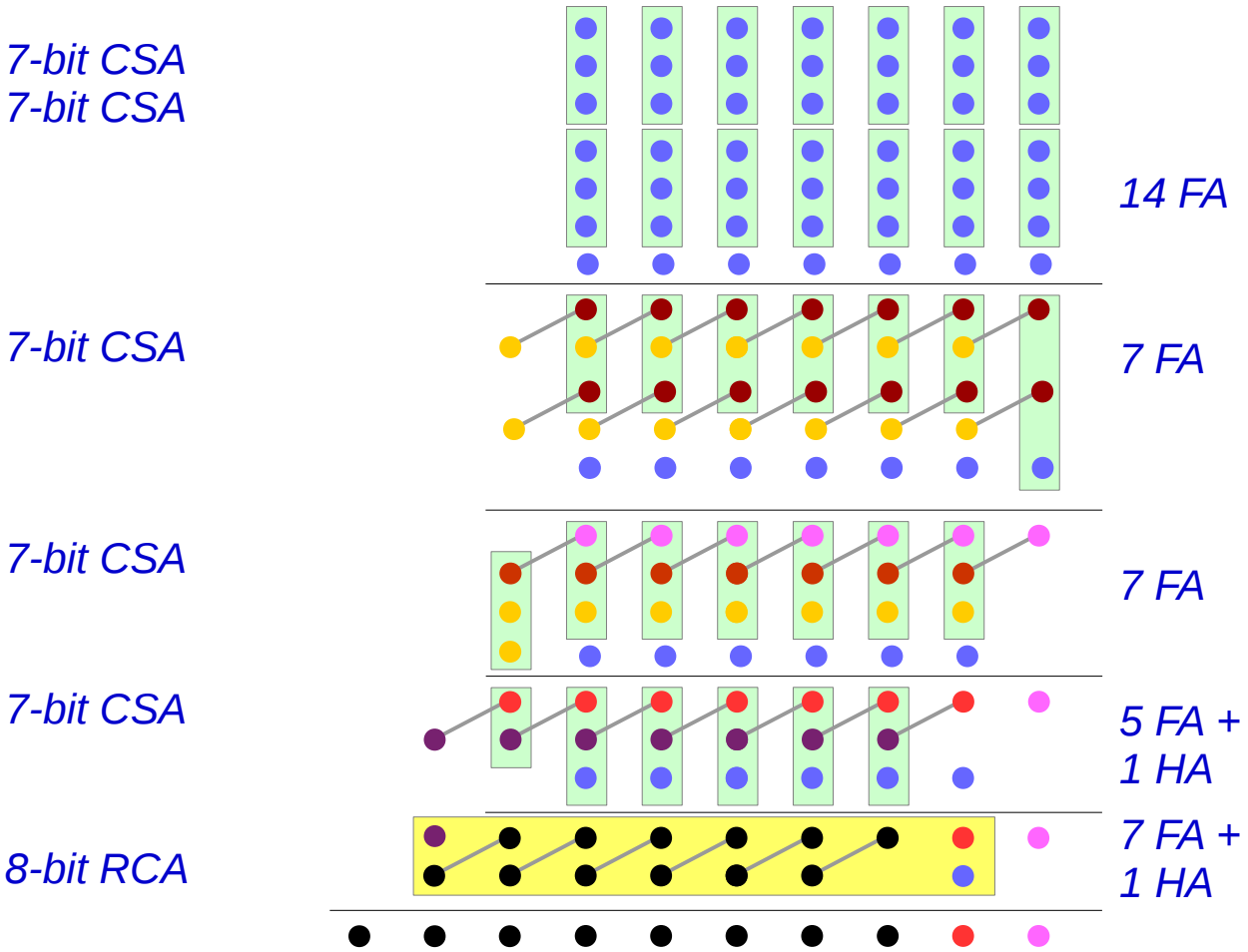
$$\vec{a} = (A_{6,} A_{5,} A_{4,} A_{3,} A_{2,} A_{1,} A_0)$$
$$\vec{b} = (B_{6,} B_{5,} B_{4,} B_{3,} B_{2,} B_{1,} B_0)$$

$$\vec{a} \cdot \vec{b} = \sum_{i=0}^{6} A_i B_i$$

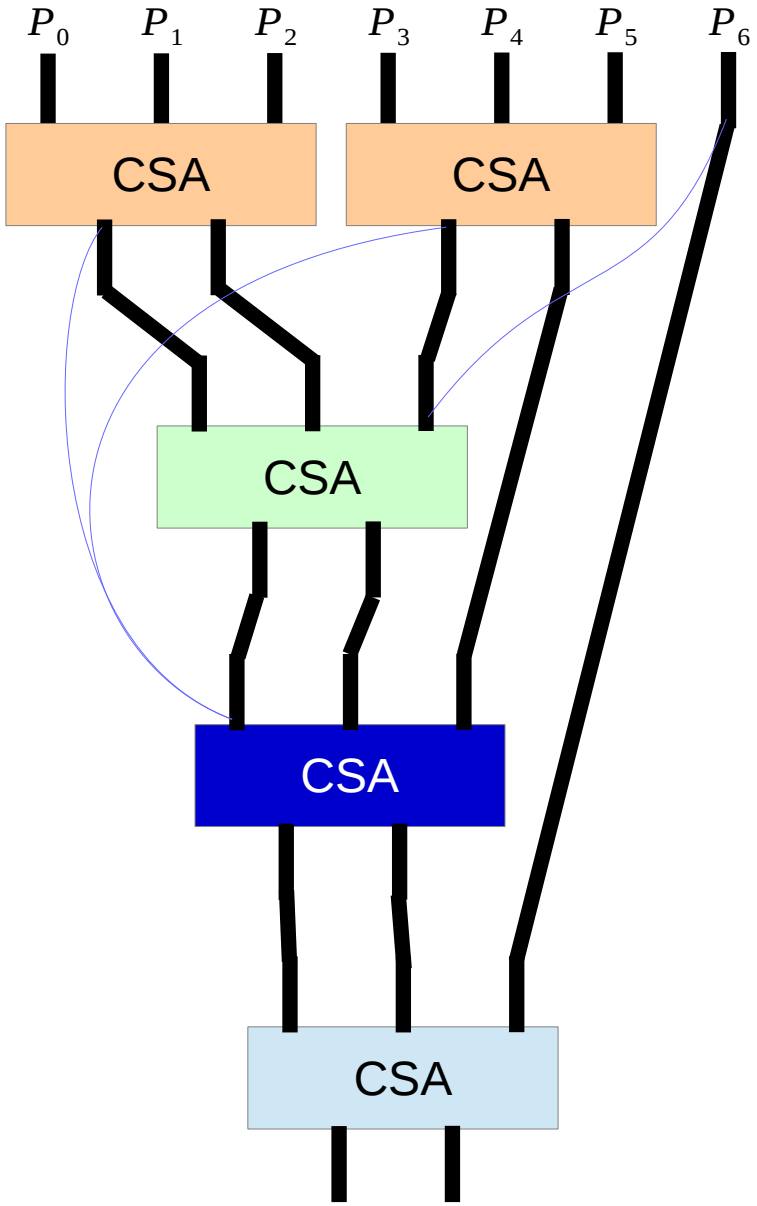
Multi-operand Addition Examples (2)

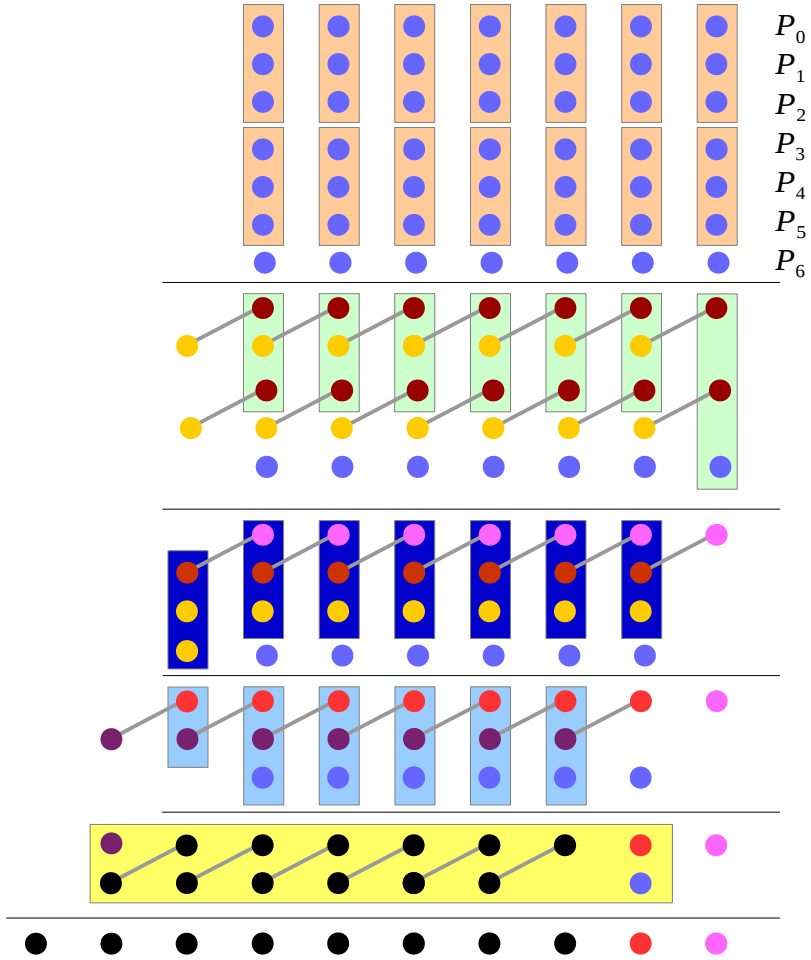


Adding seven 7-bit numbers using CSA



CSA Tree

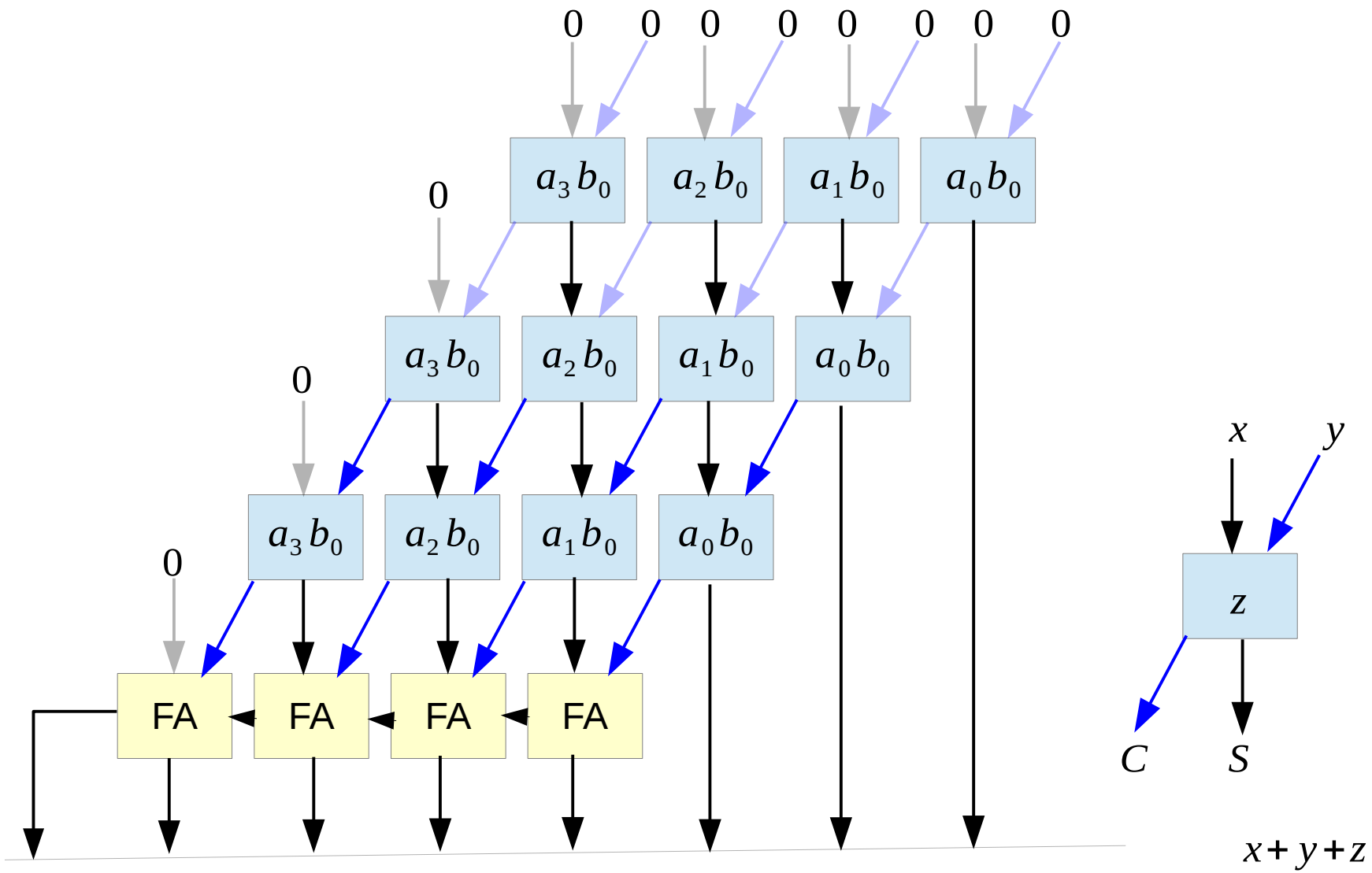




4-bit Multiplication

			a_3	a_2	a_1	a_0
			b_3	b_2	b_1	b_0
			$a_3 b_0$	$a_2 b_0$	$a_1 b_0$	$a_0 b_0$
		$a_3 b_0$	$a_2 b_0$	$a_1 b_0$	$a_0 b_0$	
	$a_3 b_0$	$a_2 b_0$	$a_1 b_0$	$a_0 b_0$		
$a_3 b_0$	$a_2 b_0$	$a_1 b_0$	$a_0 b_0$			

Multiplier using CSA



References

[1] en.wikipedia.org
[2] Parhami, “Computer Arithmetic Algorithms and Hardware Designs”