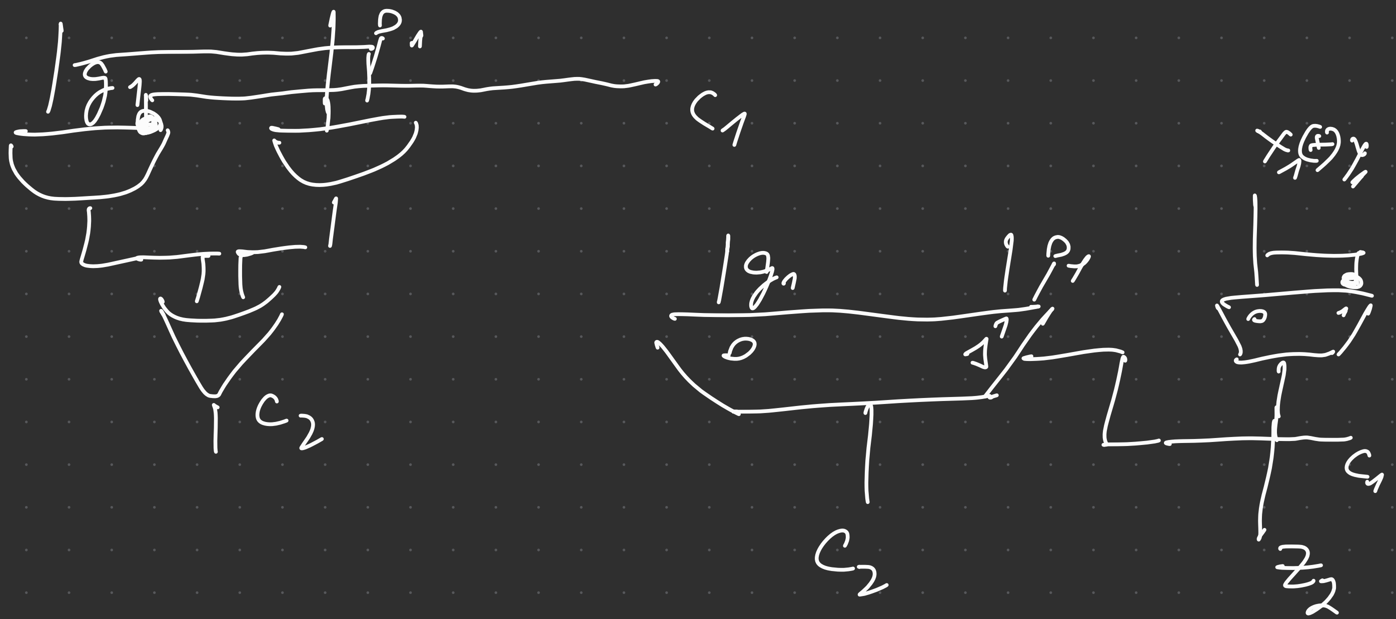
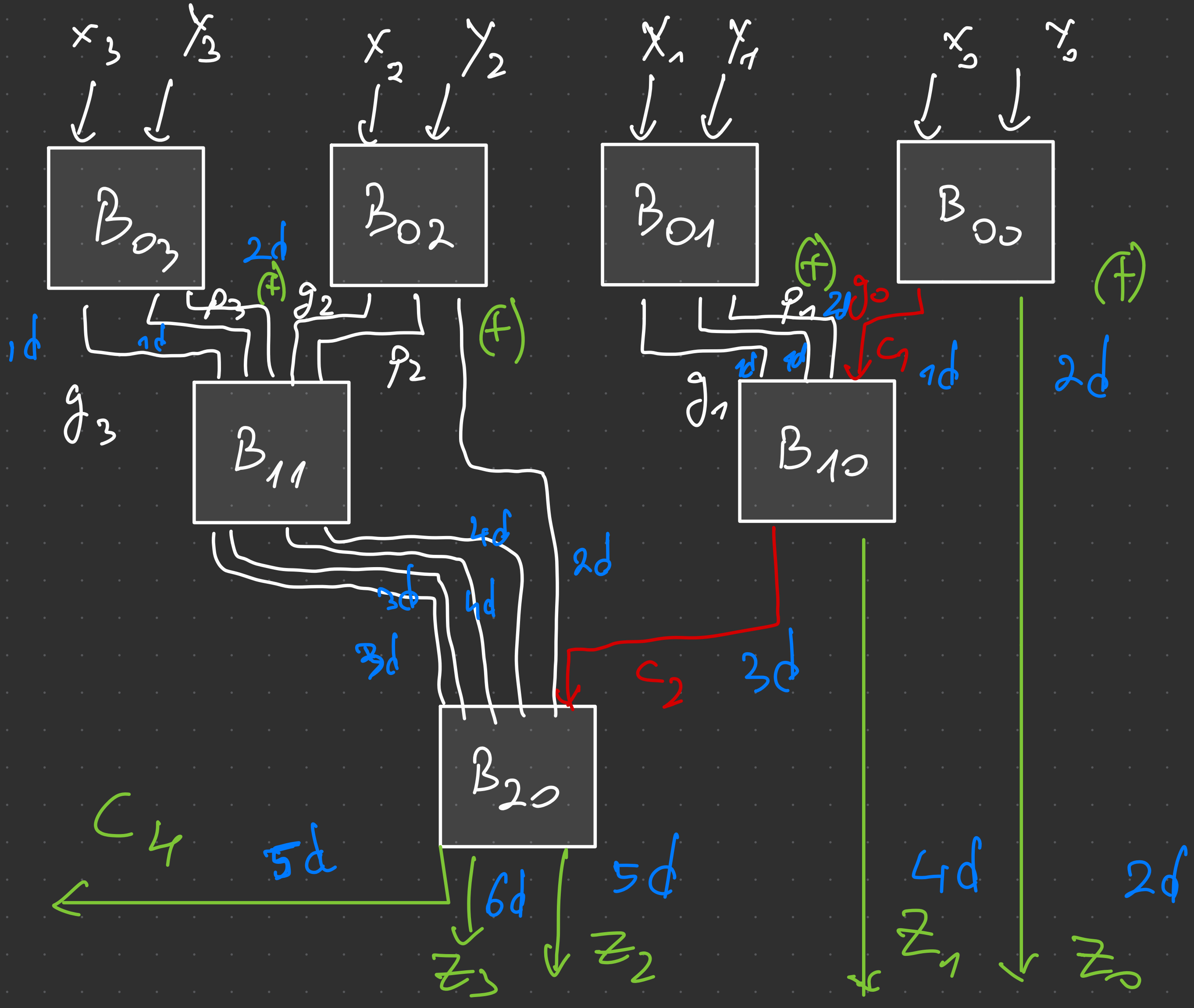
Conditional Sum Adder CSuA

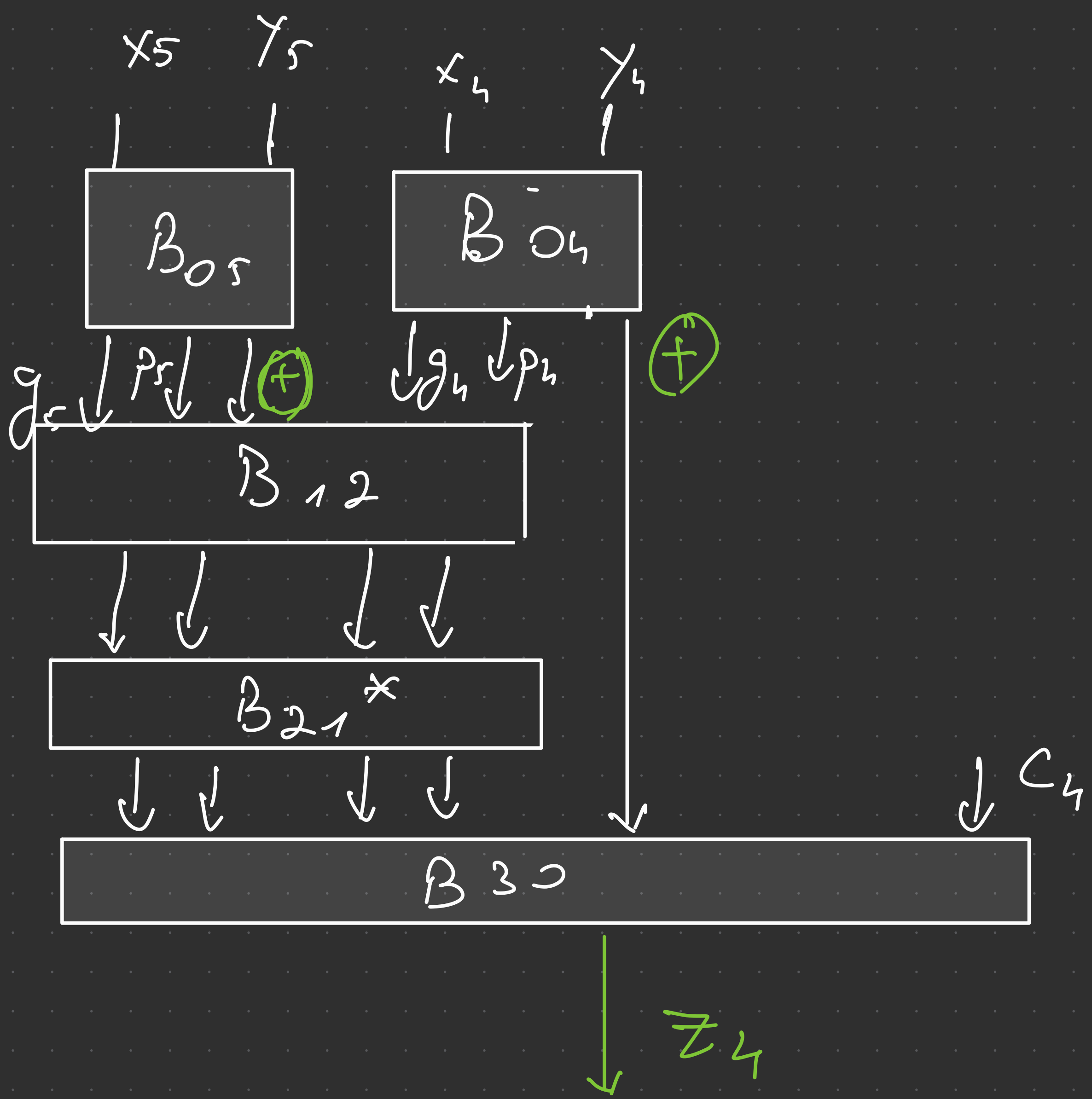


Întârzieri



n - bits $\quad \Delta^{z}_{CSuA-n} = 2d + 2\lceil \log_2 n \rceil$

$$\Delta^{cout}_{CSuA} = 1d + 2\lceil \log_2 n \rceil d$$



→ obligatoriu transport de intrare 0

Comparare latență 128 bits

CS_uA	CS_eA	$ML\text{-}CLA$	RCA
$\delta_Z = 18d$	$\delta_Z = 258d$	$\delta_Z = 31d$	$\delta_Z = 512d$
$\delta_{C_{out}} = 17d$	$\delta_{C_{out}} = 258d$	$\delta_{C_{out}} = 19d$	$\delta_{C_{out}} = 512d$

$X = 0\,1\,1\,0\,0\,1\,0\,0\,1\,1$

$Y = 1\,1\,0\,1\,1\,0\,1\,1\,1\,0$

Operand \ Rank		7		6		5		4		3		2		1		0	
X		0		1		1		0		0		1		0		1	
Y		0		1		1		1		0		1		0		1	
Block level	Carry in	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S
i=0	$c_{in}=0$	0	1	0	1	0	1	0	1	0	1	1	0	0	0	1	0
	$c_{in}=1$	1	0	1	0	1	0	1	0	1	0	1	1	0	1		
i=1	$c_{in}=0$																
	$c_{in}=1$																
i=2	$c_{in}=0$																
	$c_{in}=1$																
i=3	$c_{in}=0$																
	$c_{in}=1$																

$X = 0\,1\,1\,0\,0\,1\,0\,0\,1\,1$

$Y = 1\,1\,0\,1\,1\,0\,1\,1\,1\,0$

Block Level	Carry	9	8	7	6	5	4	3	2	1	0
	x	0	1	1	0	0	1	0	0	1	1
	y	1	1	0	1	1	0	1	1	1	0
		C S	C S	C S	C S	C S	C S	C S	C S	C S	C S
i=0	0	01	10	01	01	01	01	01	01	10	01
	1	10	11	10	10	10	10	10	10	11	
i=1	0	10	0	01	1	01	1	01	1	10	1
	1	10	1	10	0	10	0	10	0		
i=2	0	10	0	01	1	1	1	10	0	0	1
	1	10	1	10	0	0	0				
i=3	0	10	0	10	0	0	0	0	0	0	1
	1	10	1								
i=4	0	10	1	0	0	0	0	0	0	0	1
	1										

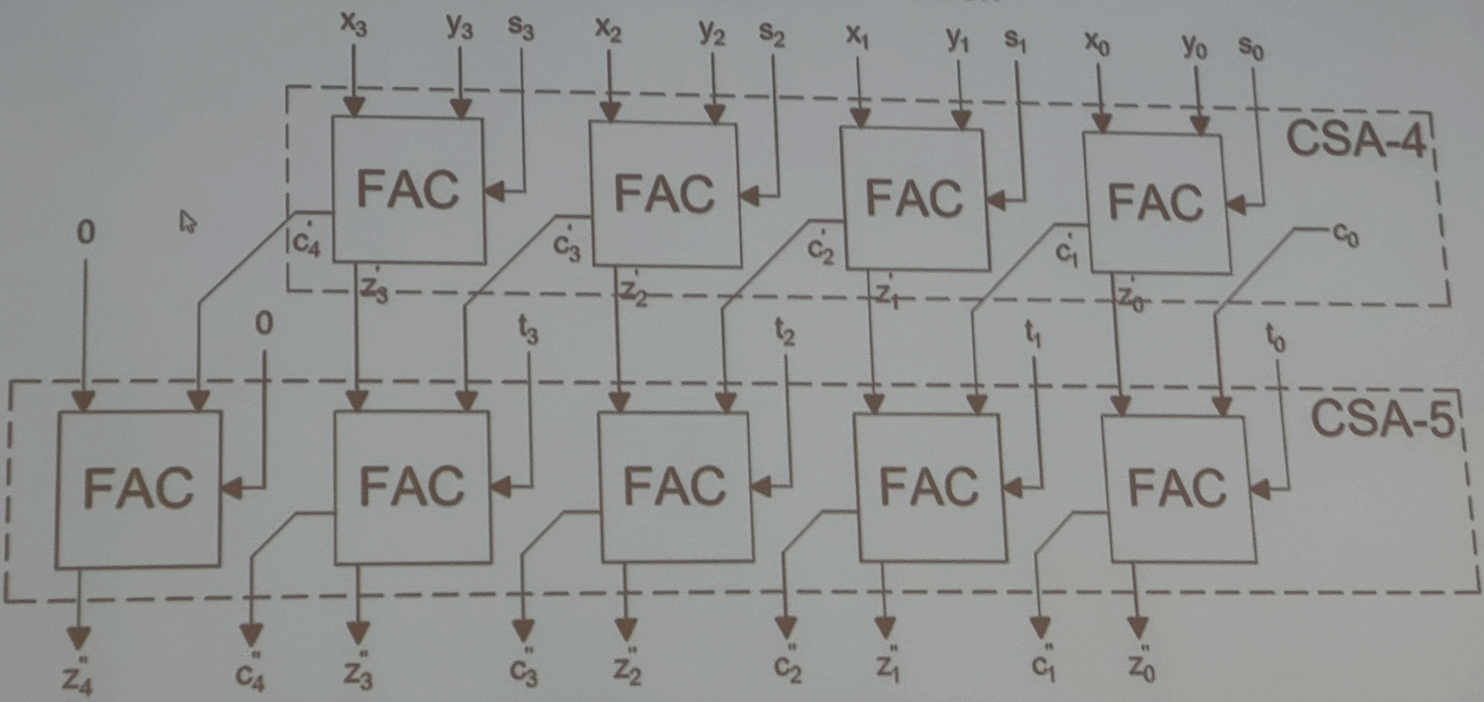
Carry Save Adder

- → sumă în formă redundant
  - → 2 vectori ⟨ sumă / transport
- → adunarea multi operand

  X, Y, S, T pe 4 biți $Z = X + Y + S + T$

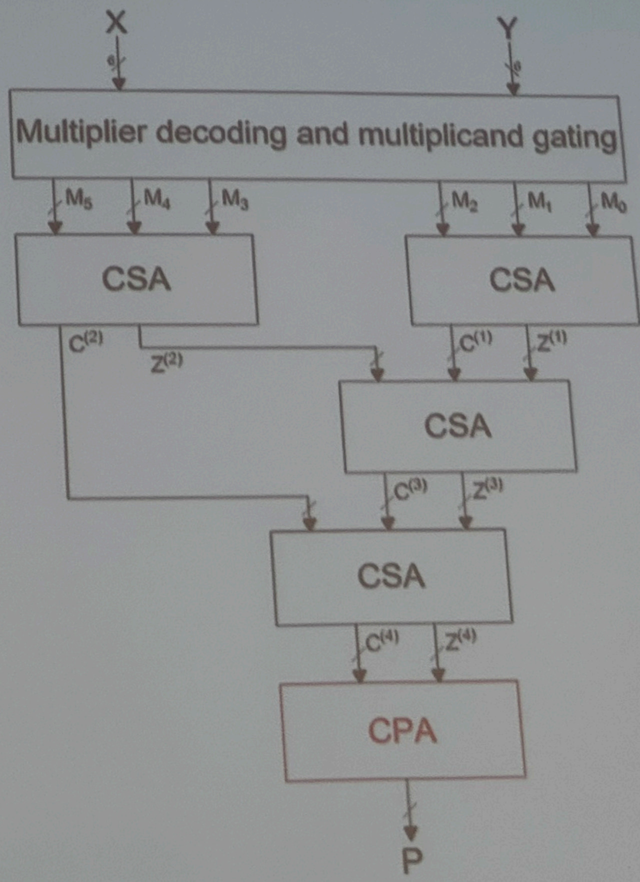
- sumă în format redundant: 2 vectori ⟨ sumă / transport
  - vectorul transport este cu o poziție mai semnificativ decât cel sumă
- permite realizarea adunării multi-operand

Se consideră operanzii X, Y, S și T, pe 4 biți. Suma $Z = X + Y + S + T$ poate fi calculata astfel:



- facilitează realizarea operației de înmulțire (combinațional)

Fie X și Y fără semn pe 6 biți. Produsul $P = X * Y$ este obținut prin adunarea produselor de 1-bit $M_i = x_i * Y * 2^i$



$$\begin{array}{llllll} & x_5 & x_4 & x_3 & x_2 & x_1 \; x_0 \end{array}$$

$X = 1\,0\,1 \,|\, 1\,0\,1 = 45$

$Y = 1\,0\,0\,1 = 9$ $\qquad$ 405

$M_i = x_i \cdot Y \cdot 2^i$

M_0	1001	M_3	1001
M_1	0000	M_4	0000
M_2	1001	M_5	1001
$Z^{(1)}$	101101	$Z^{(2)}$	101101
$C^{(1)}$	000000	$C^{(2)}$	000000

$c(1) * 2$

$2C^{(1)}$ 0 0 0 0 0 0 0 0 | 0

$Z^{(1)}$ 0 0 0 1 0 1 1 0 1

$Z^{(2)}$ 1 0 1 1 0 1 0 0 0

$Z^{(3)}$ 1 0 1 0 0 0 1 0 1

$C^{(3)}$ 0 0 0 1 0 1 0 0 0

$2C^{(3)}$ 0 0 0 1 0 1 0 0 0

$Z^{(3)}$ 1 0 1 0 0 0 1 0 1

$2 * C^{(2)}$ 0 0 0 0 0 0

$Z^{(4)}$ 0 1 0 0 0 1 0 1 0 1

$C^{(4)}$ 0 0 0 1 0 0 0 0 0 0

$2C^{(4)}$ 0 0 0 1 0 0 0 0 0 0

$Z^{(4)}$ 0 1 0 0 0 1 0 1 0 1

$\boxed{405}$

P 0 0 1 1 0 0 1 0 1 0 1

$\boxed{\text{Calcul fiabil}}$

→ disponibilitate
→ fiabilitate
→ mentenabilitate

Sumatoare binare cu control de paritate

$$
\begin{array}{ccc}
X & \leftarrow & X_p \\
Y & \leftarrow & Y_p \\
\hline
Z & \leftarrow & Z_p \\
C_{out} & &
\end{array}
$$

$$\boxed{\delta S} \longrightarrow \boxed{VS}$$

$$x_p = x_{n-1} \oplus x_{n-2} \oplus \dots \oplus x_0$$

$$y_p = y_{n-1} \oplus \dots \oplus y_0$$

$$z_p = \text{— // —}$$

$$z_i = x_i \oplus y_i \oplus c_i$$

$$z_p = x_p \oplus y_p \oplus \underbrace{(c_{n-1} \oplus c_{n-2} \oplus \dots \oplus c_0)}_{c_p}$$