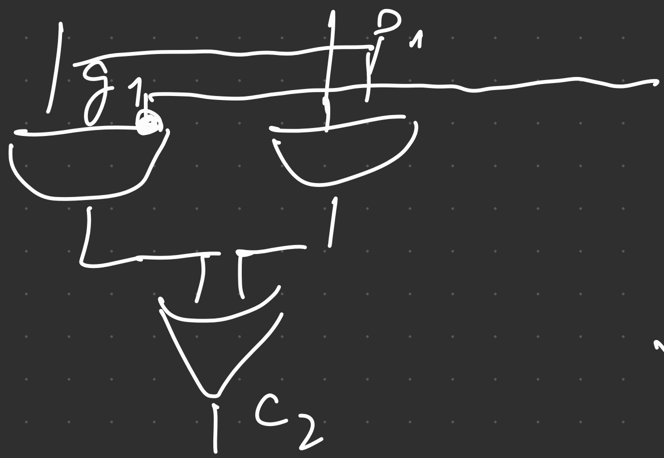
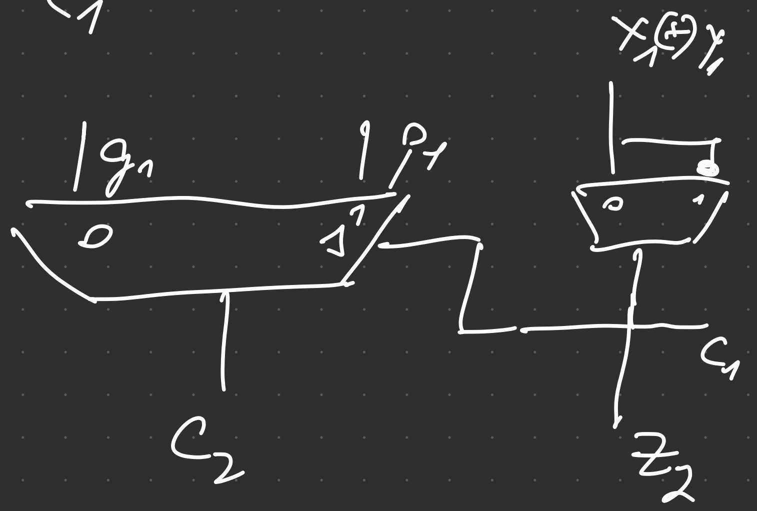
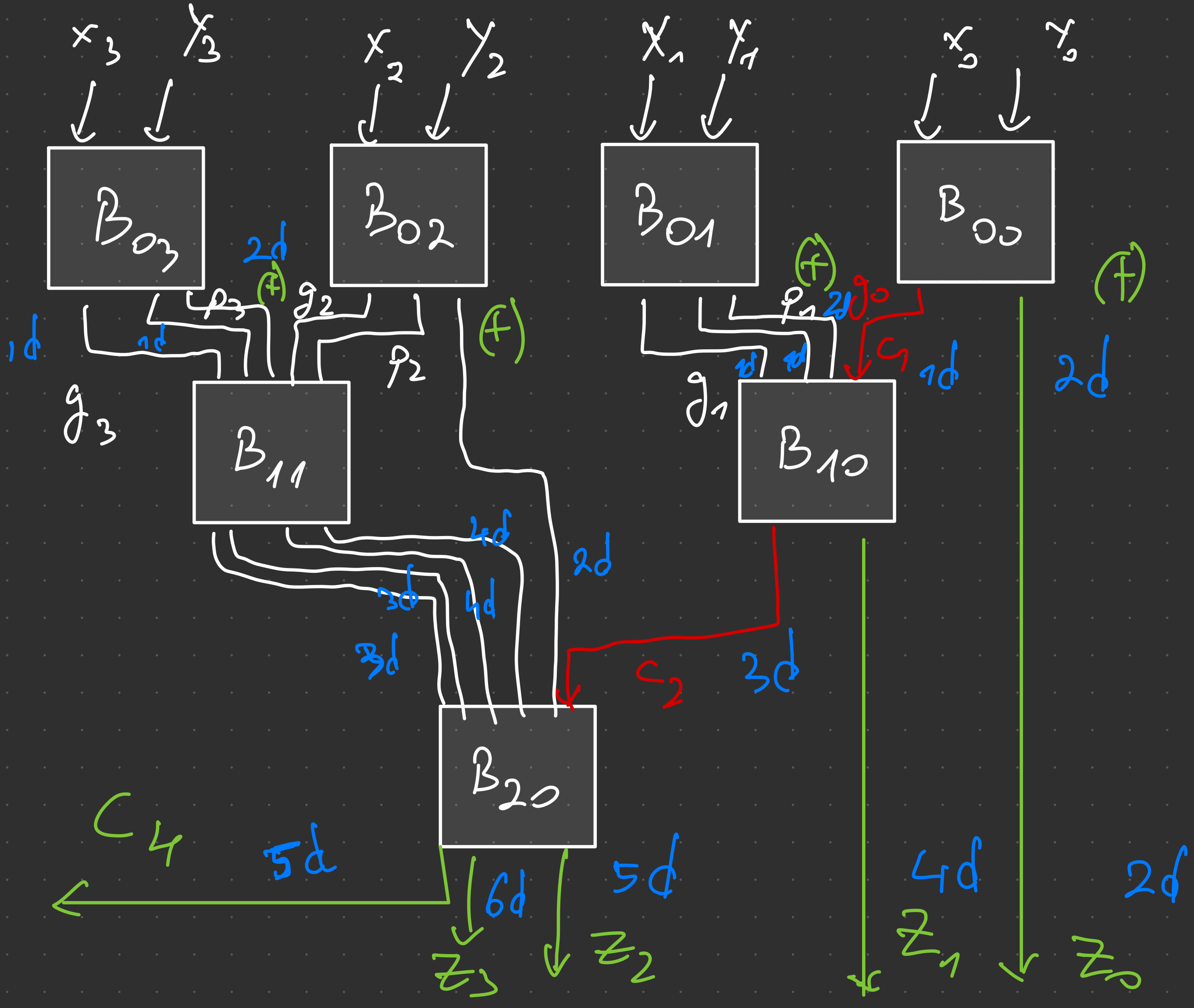
Conditional Sum Adder CSuA



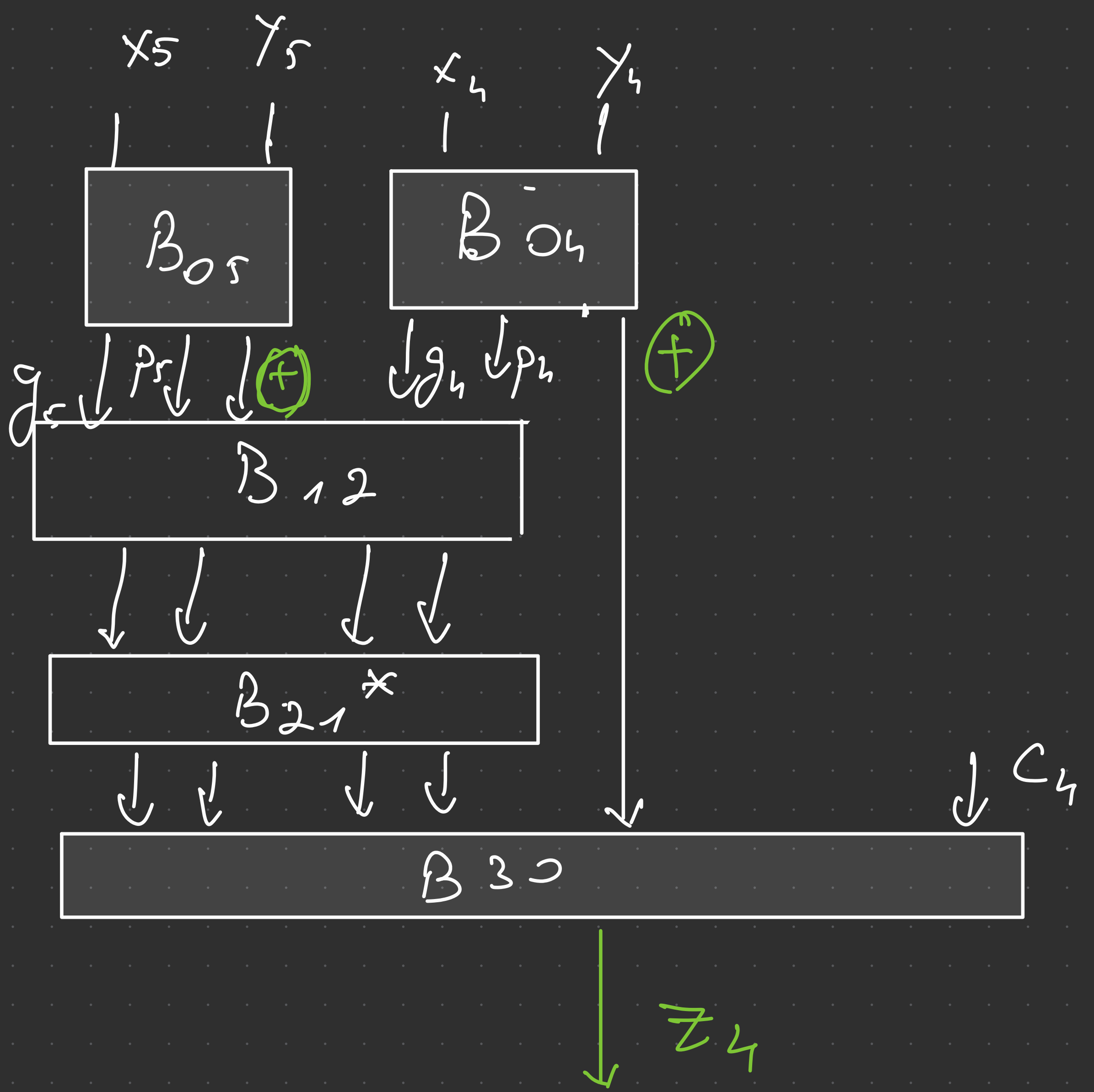


Întârzieri



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

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



→ obligatoriu transport de intrare 0

Comparare latență   128 bits

CSuA	CSeA	ML-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	$c_{in}=0$																
	$c_{in}=1$																

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

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

		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
Block Level	Carry	C S	C S	C S	C S	C S	C S	C S	C S	C S	C S
i = 0	0	0 1	1 0	0 1	0 1	0 1	0 1	0 1	0 1	1 0	0 1
	1	1 0	1 1	1 0	1 0	1 0	1 0	1 0	1 0	1 1	
i = 1	0	1 0	0	0 1	1	0 1	1	0 1	1	1 0	1
	1	1 0	1	1 0	0	1 0	0	1 0	0		
i = 2	0	1 0	0	0 1	1	1	1	1 0	0	0	1
	1	1 0	1	1 0	0	0	0				
i = 3	0	1 0	0	1 0	0	0	0	0	0	0	1
	1	1 0	1								
i = 4	0	1 0	1	0	0	0	0	0	0	0	1
	1										

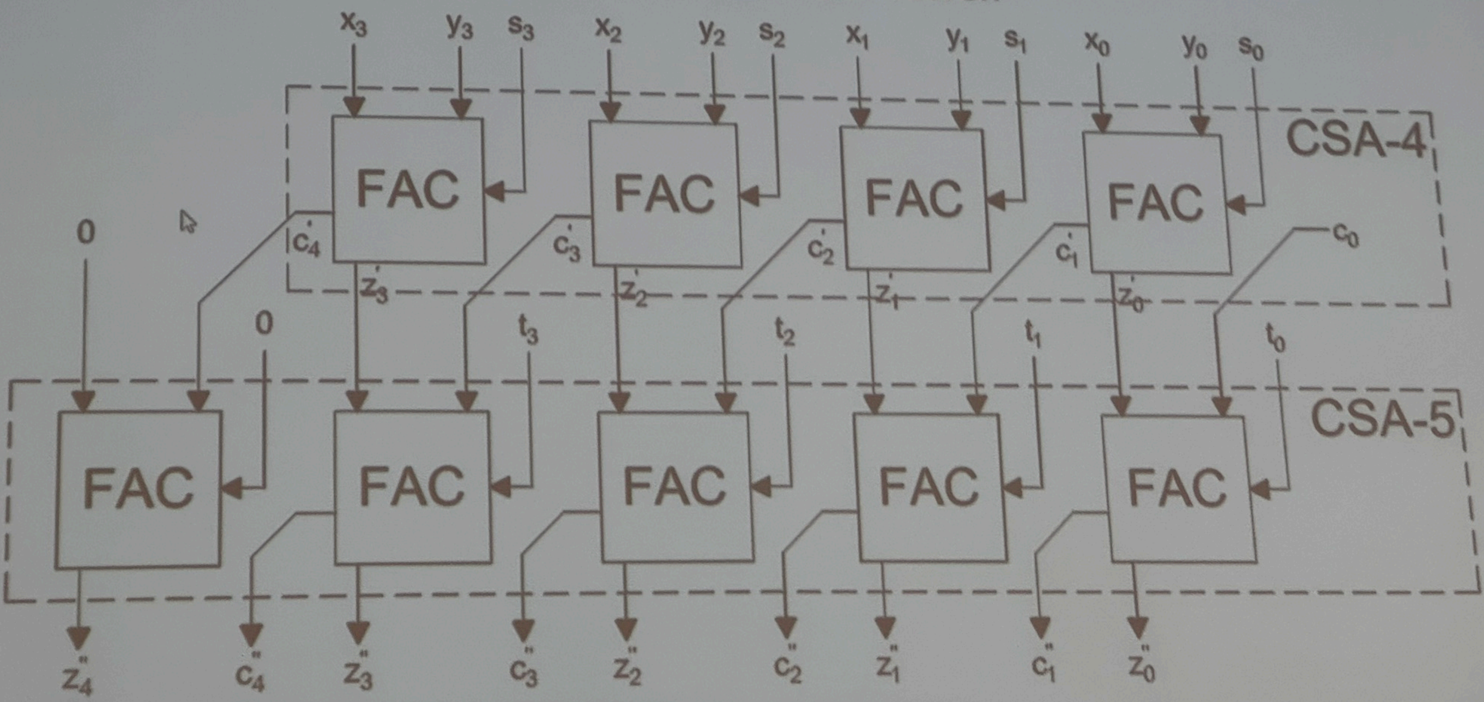
Carry Save Adder

- → 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

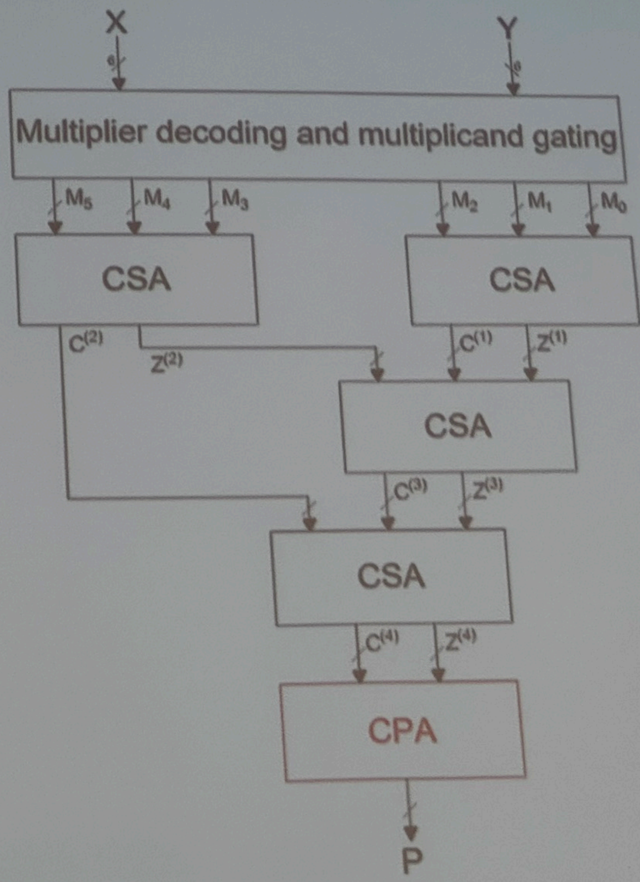
Se consideră operanzii X, Y, S și T, pe 4 biți. Suma $Z = X + Y + S + T$ poate fi calculata astfel:



2.3.5 Carry Save Adder (contin.)

- 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 $M_i = x_i * Y * 2^i$



$$\begin{array}{lcccccc} & x_5 & x_4 & x_3 & x_2 & x_1 & x_0 \\ X = & 1 & 0 & 1 & 1 & 0 & 1 \end{array} = 45$$

$Y = 1001 = 9$ 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	$C^{(2)}$	0000000

$c(1) * 2$

$2C^{(1)}$ 0 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

Calcul fiabil

- → disponibilitate
- → fiabilitate
- → mentenabilitate

Sumatoare binare cu control de paritate

$$
\begin{array}{ccc}
X & \leftarrow & x_p \\
Y & \leftarrow & y_p \\
\hline
Z & \leftarrow & z_p \\
C_{out} & &
\end{array}
$$

$$\boxed{DS} \longrightarrow \boxed{VS}$$

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

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

$$z_p = \text{—}||\text{—}$$

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

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