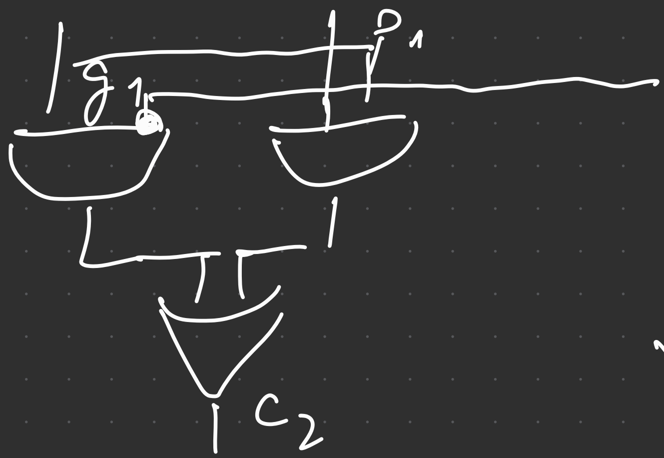
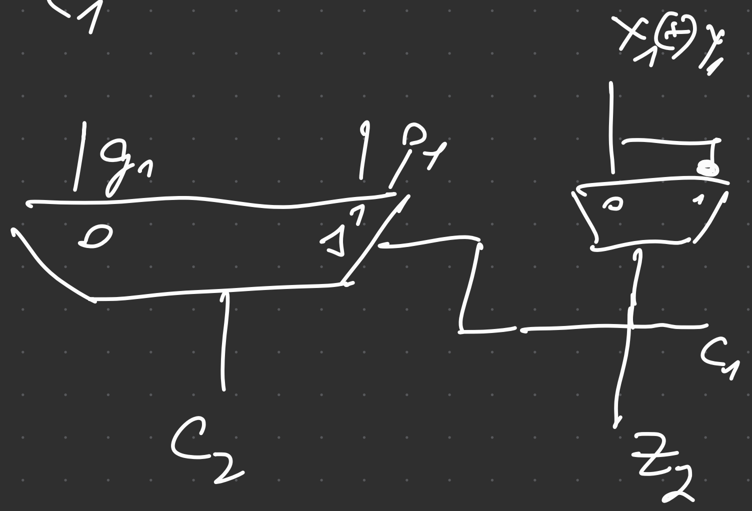
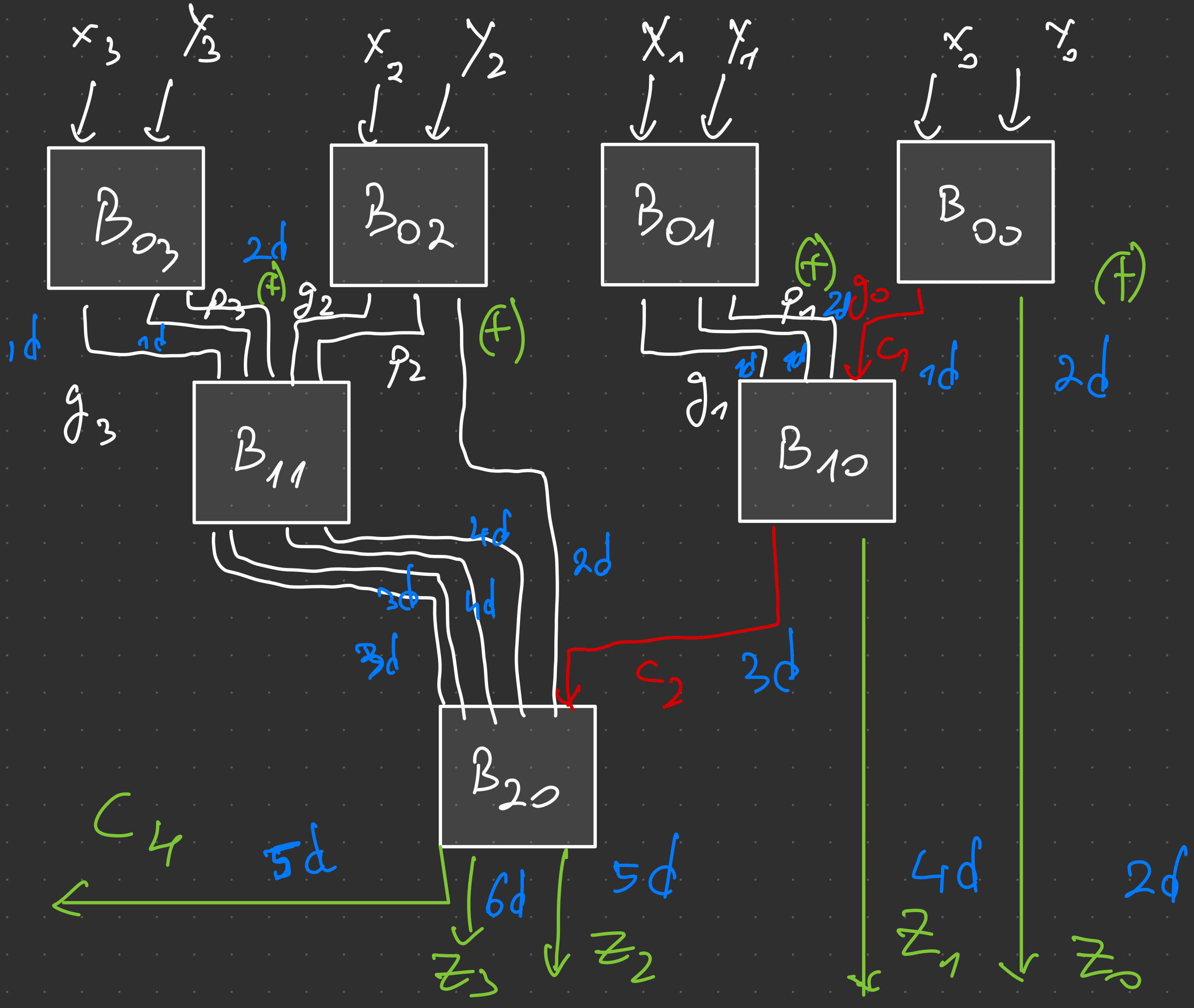
Conditional Sum Adder CSuA



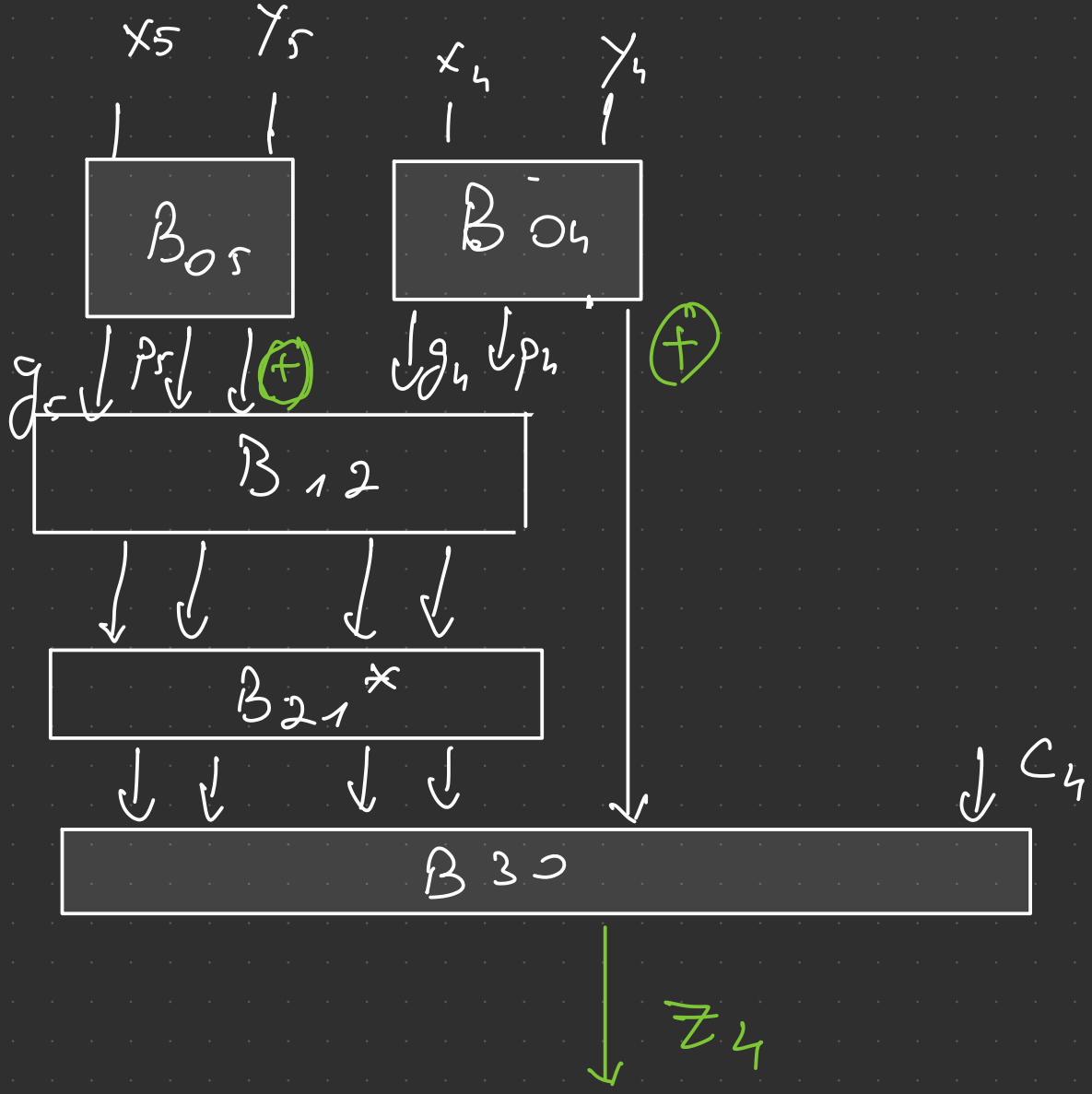


Întârzieri



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

$\Delta_{CSuA}^{Cout} = 1d + 2\lceil \log_2 n \rceil d$



→ obligatoire transport de retenue 0

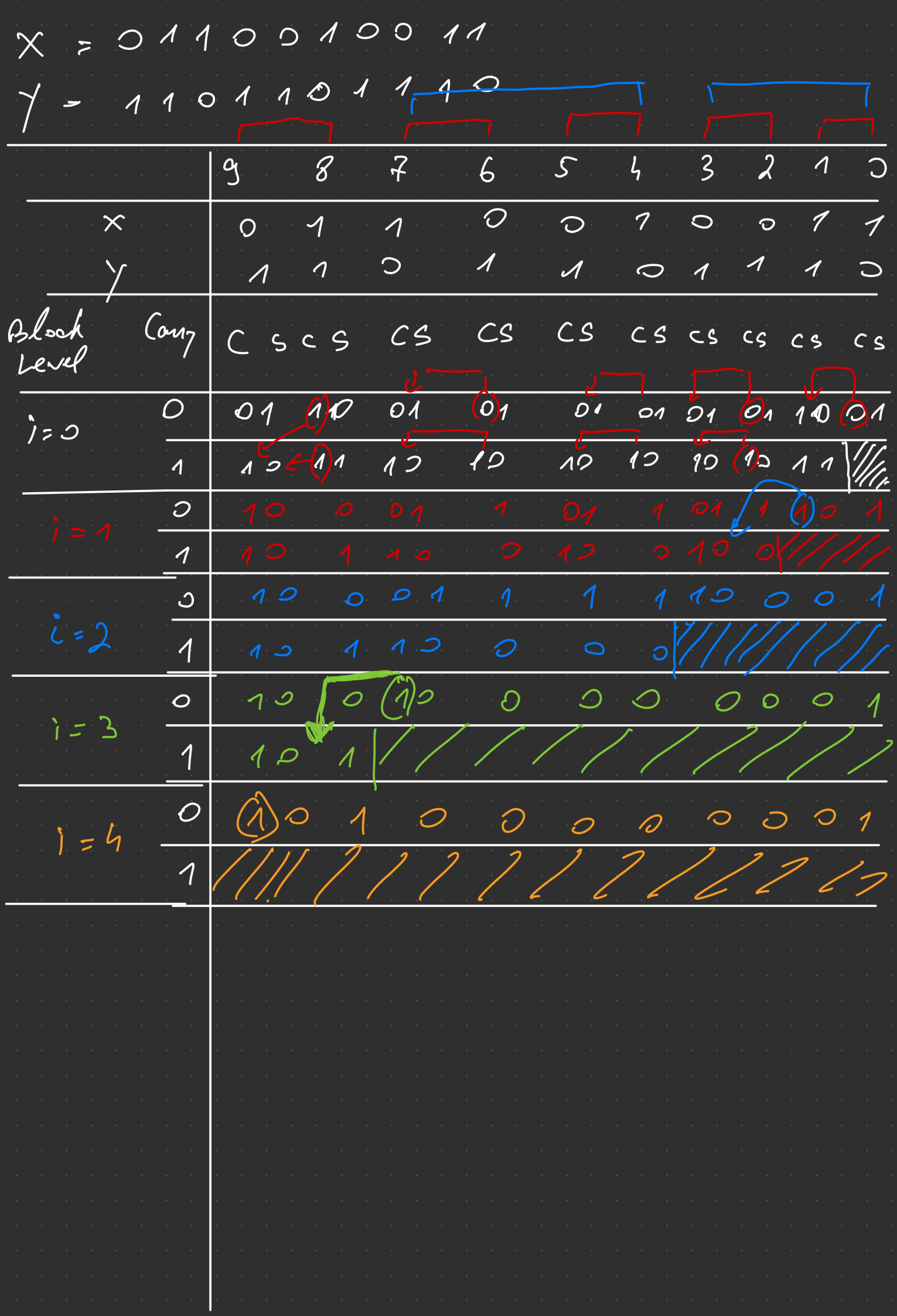
Comparare latență — 128 biți

CSuA	CSeA	ML-CLA	RCA
$t_z = 18d$	$t_z = 258d$	$t_z = 31d$	$t_z = 512d$
$t_{Cout} = 17d$	$t_{Cout} = 258d$	$t_{Cout} = 19d$	$t_{Cout} = 512d$

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

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

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	$c_{in}=0$																
	$c_{in}=1$																

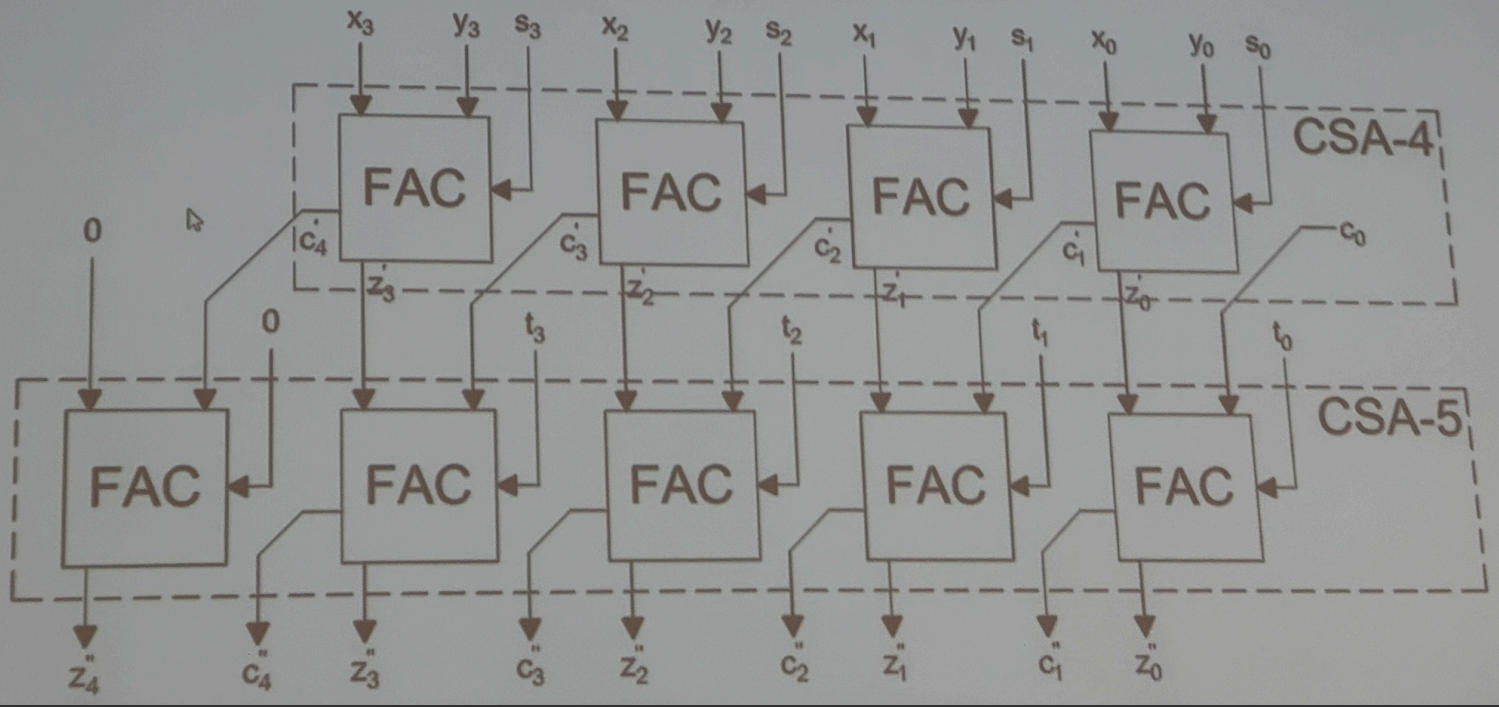

X = 0 1 1 0 0 1 0 0 1 1
Y = 1 1 0 1 1 0 1 1 1 0
9 8 7 6 5 4 3 2 1 0
X 0 1 1 0 0 1 0 0 1 1
Y 1 1 0 1 1 0 1 1 1 0
Block Level
Carry
C S C S C S C S C S C S C S C S C S C S
i=0
i=1
i=2
i=3
i=4

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

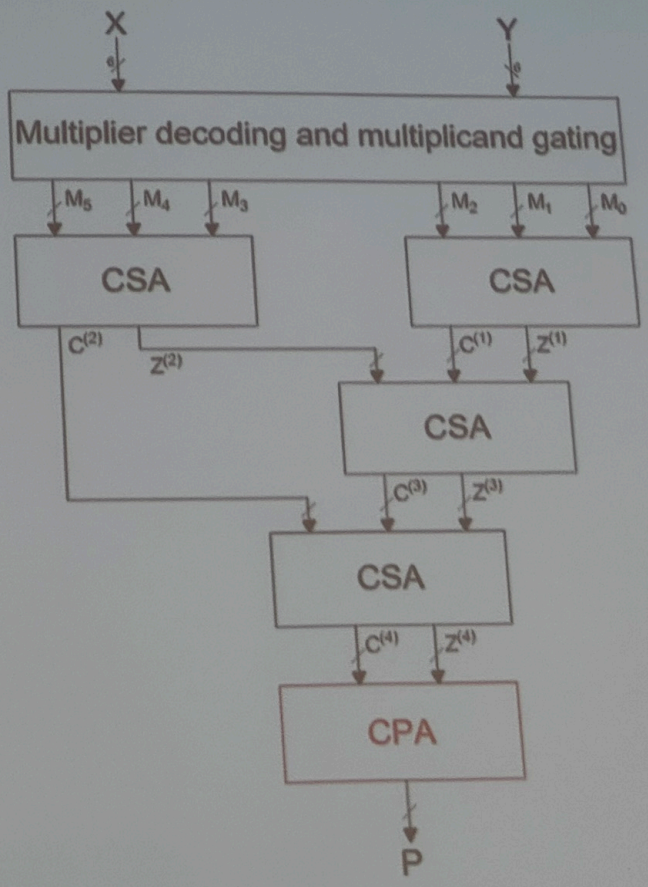
Se consideră operanzii X, Y, S și T, pe 4 biți. Suma $Z = X + Y + S + T$ poate fi calculata astfel:



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 $M_i = x_i * Y * 2^i$



$x_5 x_4 x_3 | x_2 x_1 x_0$

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

$Y = \quad 1\ 0\ 0\ 1 = 9$

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

M_0	1001	M_3	1001
M_1	0000	M_4	0000
M_2	1001	M_5	1001
$Z^{(1)}$	1011101	$Z^{(2)}$	1011101
$C^{(1)}$	0000000	$C^{(2)}$	0000000

C(1) *2

2C(1) 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

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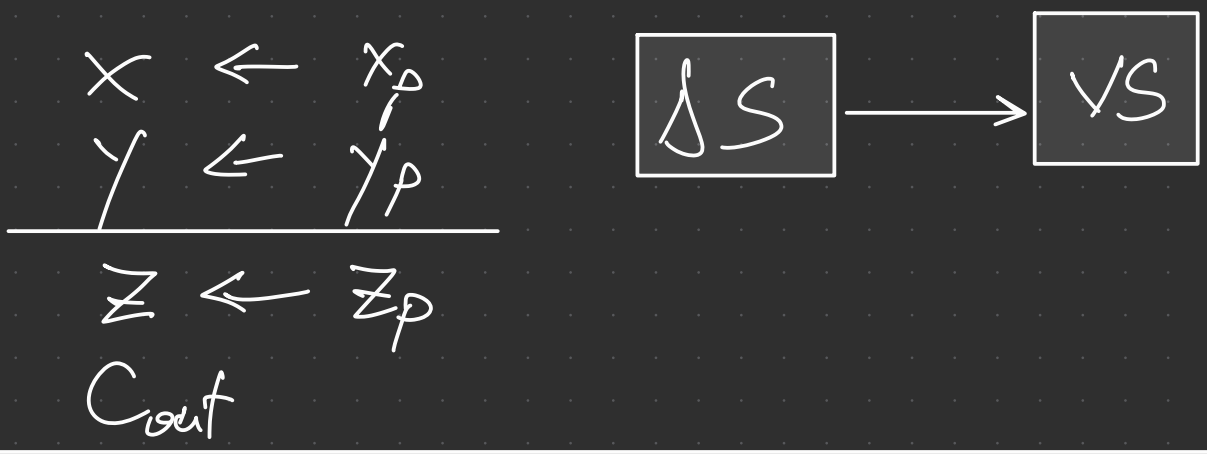
P 0 0 1 1 0 0 1 0 1 0 1

Calcul fiabil

- → disponibilitate
- → fiabilitate
- → mentenabilitate

Sumatoare binare cu control de paritate



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

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

$$z_p = \text{— " —}$$

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

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