

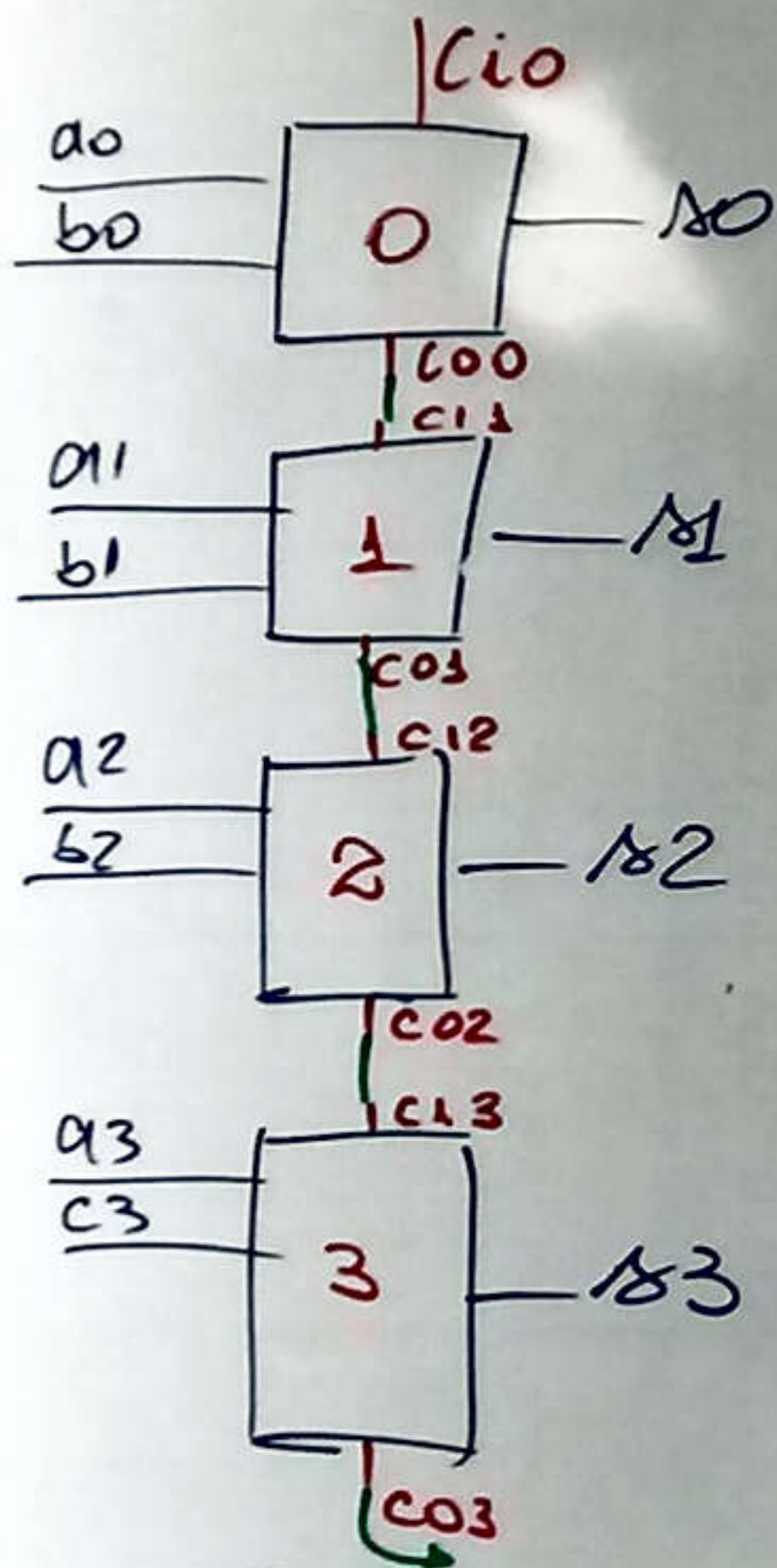
$$f = \frac{1}{10\text{ns}} = \frac{1}{10 \times 10^{-9} \text{ s}}$$

$$= \frac{1}{1 \times 10^{-8} \text{ s}}$$

$$= 1 \times 10^8 \text{ Hz}$$

$$= 10 \times 10^7 \text{ Hz}$$

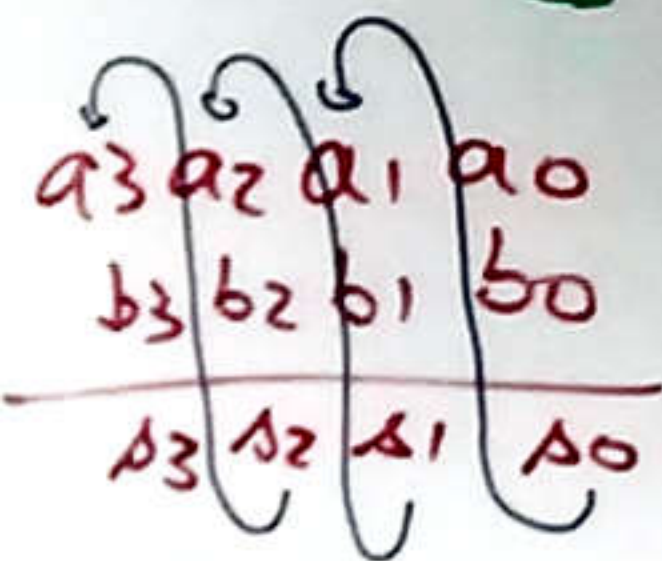
$$= 100 \times 10^6 \text{ Hz} \longrightarrow 100 \text{ MHz}$$

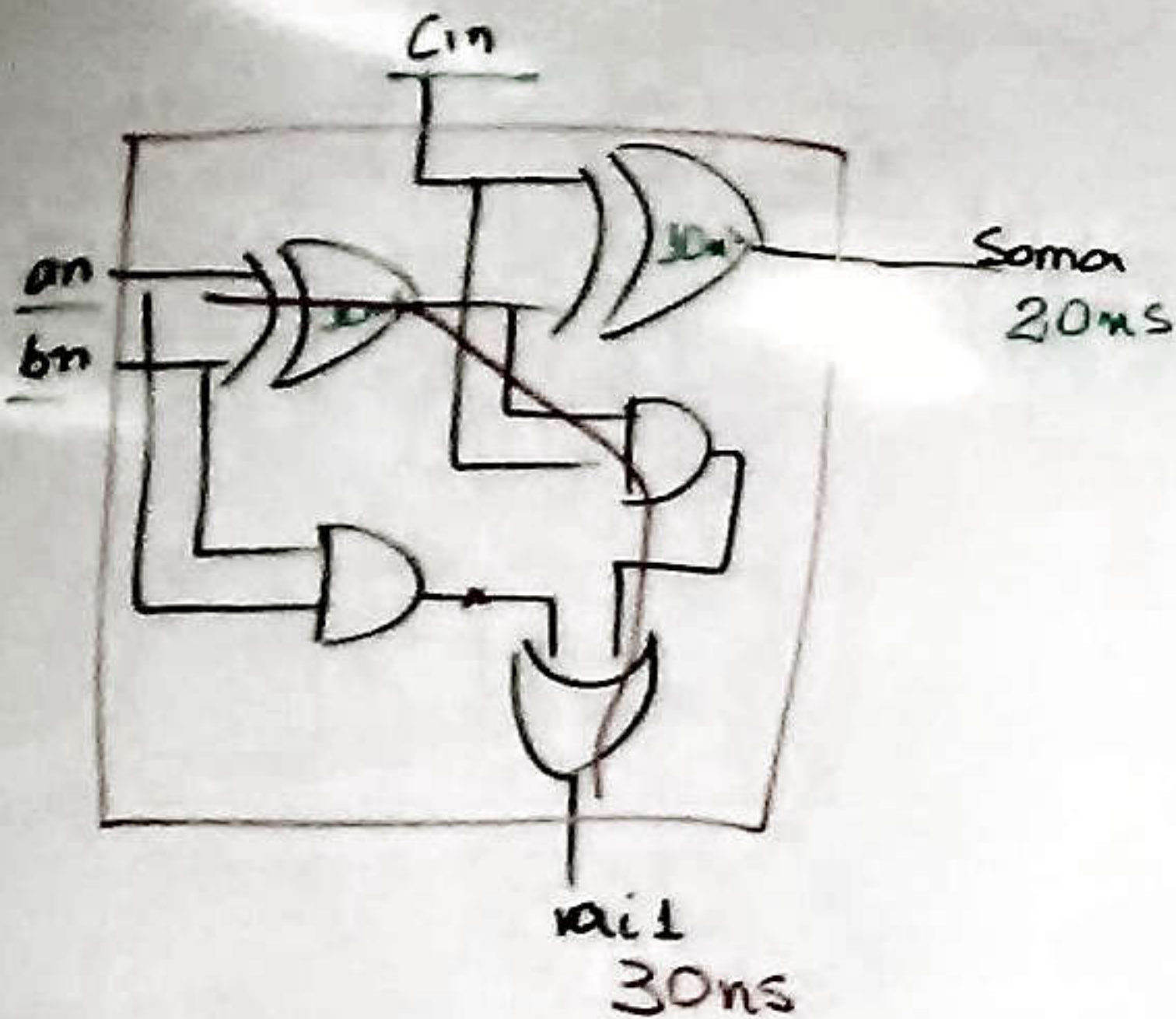


a_n	b_n	c_{in}	s_n	c_{out}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$$s_n = \bar{a}_n \cdot \bar{b}_n \cdot c_{in} + \bar{a}_n \cdot b_n \cdot \bar{c}_{in} + a_n \cdot \bar{b}_n \cdot \bar{c}_{in} + a_n \cdot b_n \cdot c_{in}$$

$$c_{out} = \bar{a}_n \cdot b_n \cdot c_{in} + a_n \cdot \bar{b}_n \cdot c_{in} + a_n \cdot b_n \cdot \bar{c}_{in} + a_n \cdot b_n \cdot c_{in}$$





Somaden 4 bit:

$$f = \frac{1}{T} = \frac{1}{120\text{ns}} = \frac{1}{120 \times 10^{-9}}$$

$$= \frac{1}{1,2 \times 10^{-7}}$$

$$= 0,8 \times 10^7 = 8 \times 10^6 \text{ Hz}$$

$$= 8 \text{ MHz}$$

$$C_{0n} = \bar{a}_n \cdot b_n \cdot c_{in} + a_n \cdot \bar{b}_n \cdot c_{in} + a_n \cdot b_n \cdot \bar{c}_{in} + a_n \cdot b_n \cdot c_{in} + a_n \cdot b_n \cdot c_{in} + a_n \cdot b_n \cdot c_{in}$$

$$= b_n \cdot c_{in} (a_n + a_n) + a_n \cdot c_{in} (\bar{b}_n + b_n) + a_n \cdot b_n (c_{in} + c_{in})$$

$$C_{0n} = a_n \cdot b_n + a_n \cdot c_{in} + b_n \cdot c_{in}$$

$$C_{0\phi} = a_\phi \cdot b_\phi + a_\phi \cdot c_{i\phi} + b_\phi \cdot c_{i\phi}$$

$$C_{01} = a_1 \cdot b_1 + a_1 \cdot c_{i1} + b_1 \cdot c_{i1}$$

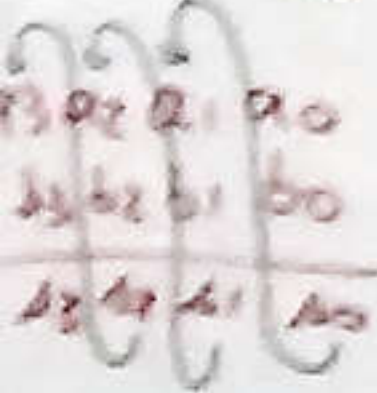
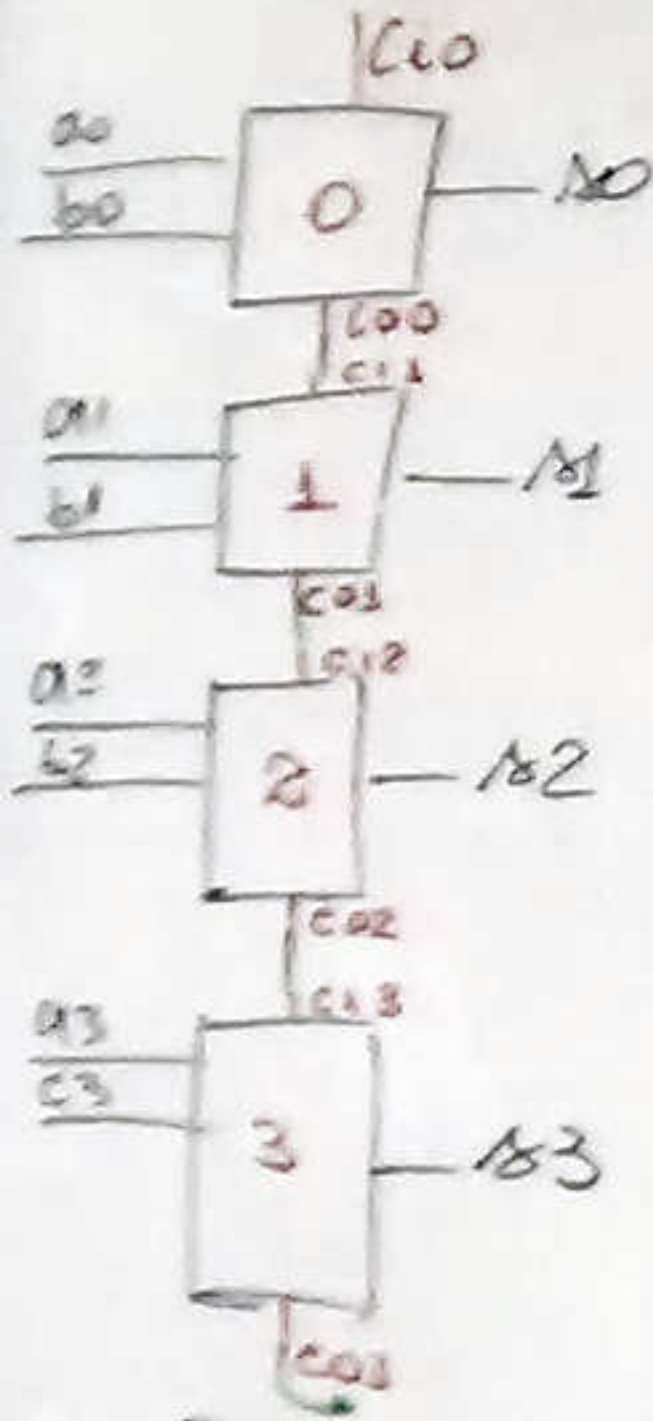
$$C_{01} = a_1 \cdot b_1 + a_1 \cdot a_\phi \cdot b_\phi + a_1 \cdot a_\phi \cdot c_{i\phi} + a_1 \cdot b_\phi \cdot c_{i\phi} + b_1 \cdot a_\phi \cdot b_\phi + b_1 \cdot a_\phi \cdot c_{i\phi} + b_1 \cdot b_\phi \cdot c_{i\phi}$$

$$C_{02} = a_2 \cdot b_2 + a_2 \cdot c_{i2} + b_2 \cdot c_{i2}$$

$$C_{02} = a_2 \cdot b_2 + a_2 \cdot (\dots) + b_2 \cdot (\dots)$$

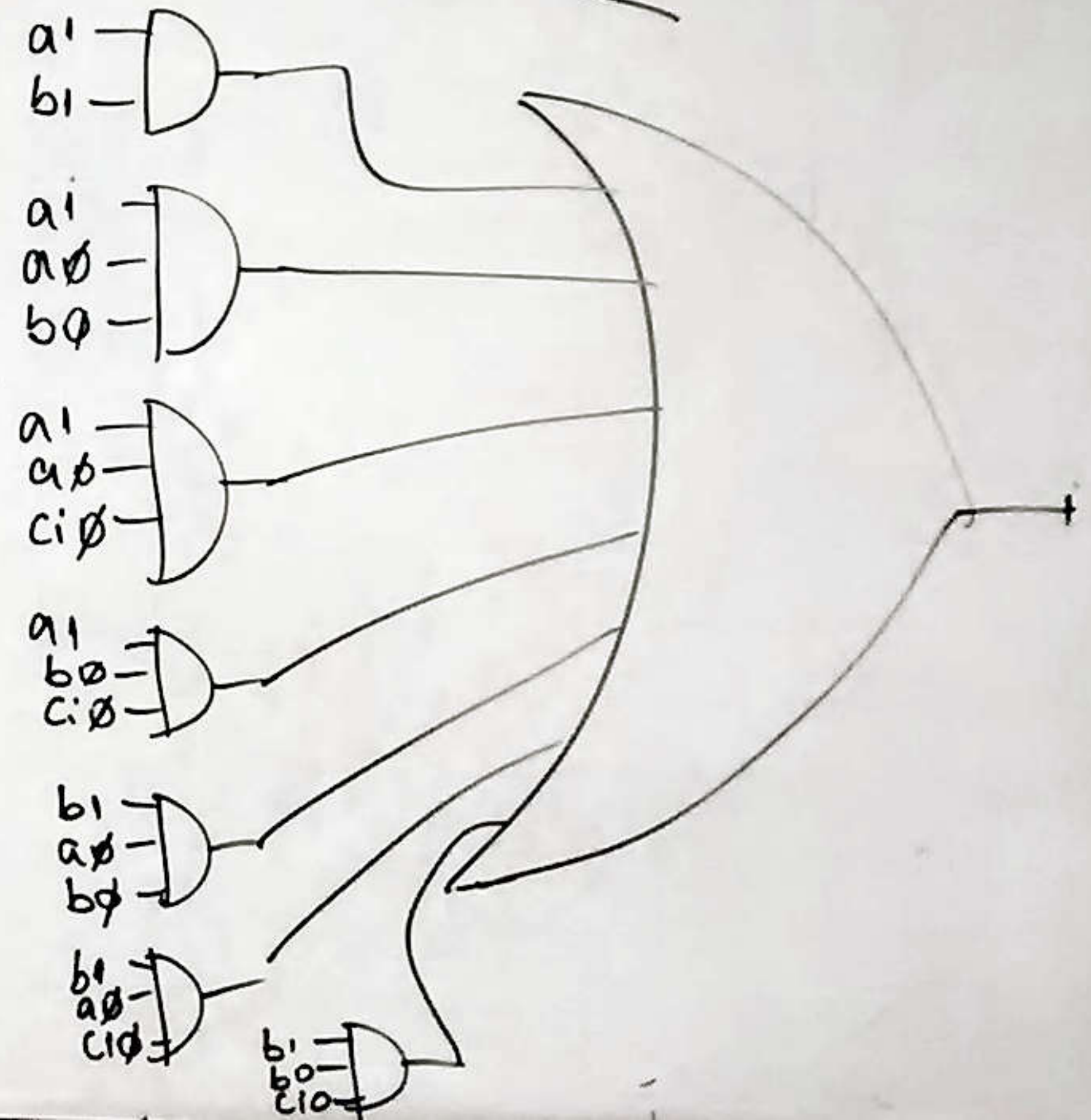
...

$$C_{03} = f \{ C_{i\phi}, a_0, a_1, a_2, a_3, b_0, b_1, b_2, b_3 \}$$



$$\{ C_{i1} = C_{0\phi} \}$$

$$\{ C_{i2} = C_{01} \}$$



$$C_{0n} = a_n \bar{b}_n \cdot c_{in} + a_n \bar{b}_n \cdot c_{in} + a_n \bar{b}_n \cdot c_{in} + a_n \bar{b}_n \cdot c_{in} + a_n \bar{b}_n \cdot c_{in} + a_n \bar{b}_n \cdot c_{in}$$

$$= b_n \cdot c_{in} (a_n \bar{a}_n + a_n) + a_n \cdot c_{in} (b_n \bar{b}_n + b_n) + a_n \cdot b_n (c_{in} \bar{c}_{in} + c_{in})$$

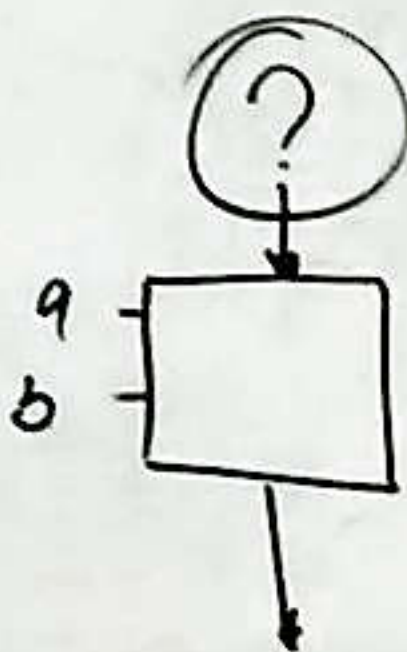
$$C_{0n} = a_n \cdot b_n + (a_n + b_n) \cdot c_{in}$$

1ª abstracção

$$C_{n+1} = \underbrace{a_n \cdot b_n}_{g_n} + \underbrace{(a_n + b_n)}_{p_n} \cdot c_n$$

$g \rightarrow$ gerador $(a \cdot b)$

$p \rightarrow$ propagador $=(a+b)$



$$e_1 = g_0 + p_0 \cdot e_0$$

$$e_2 = g_1 + p_1 \cdot c_1$$

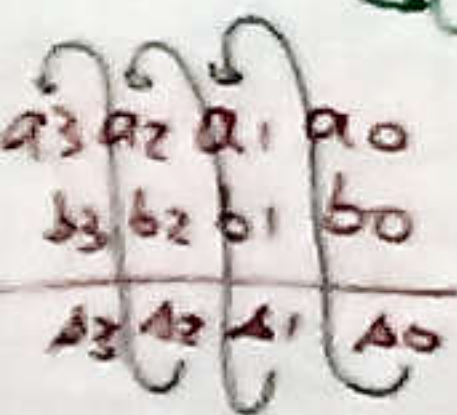
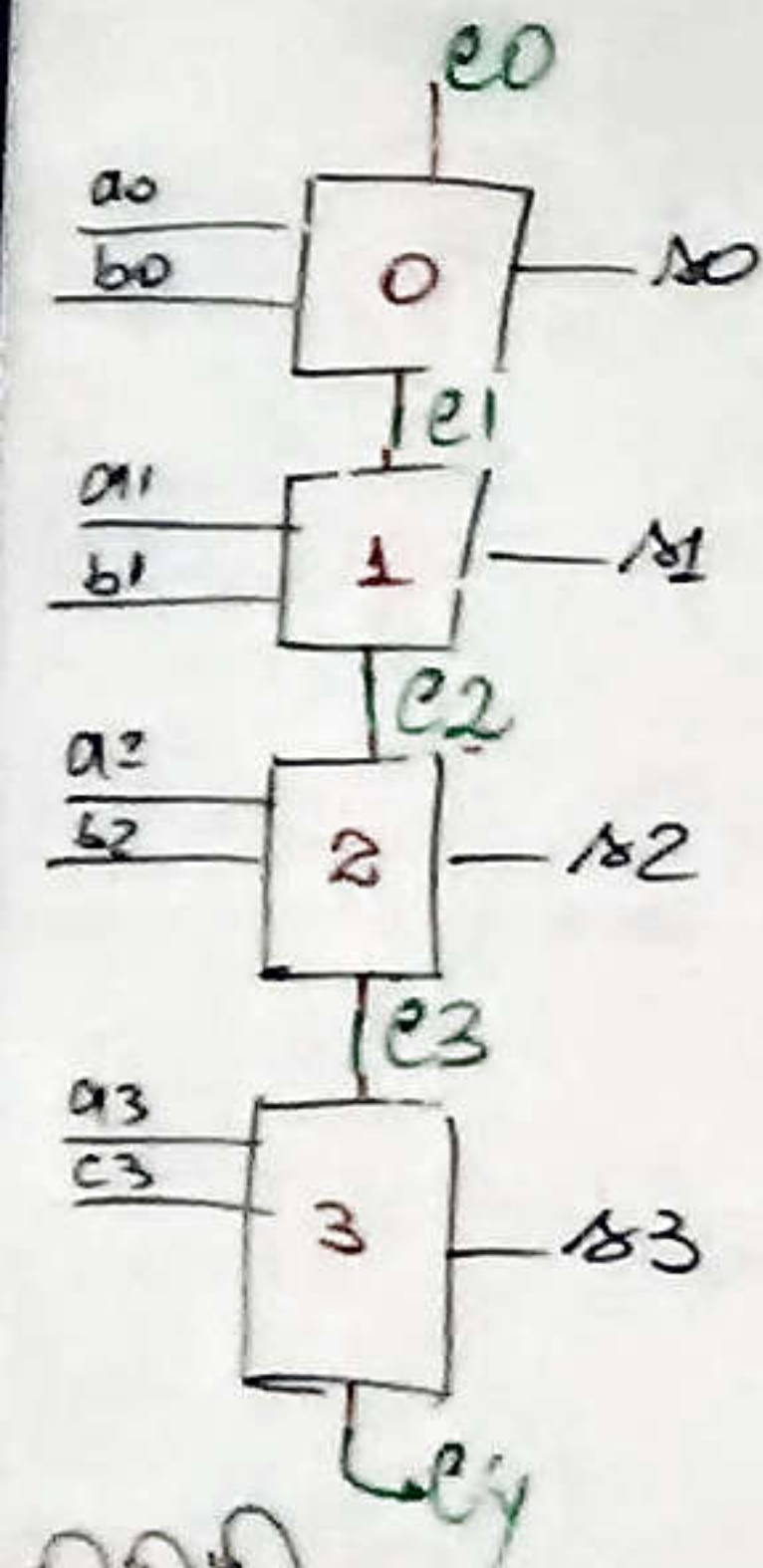
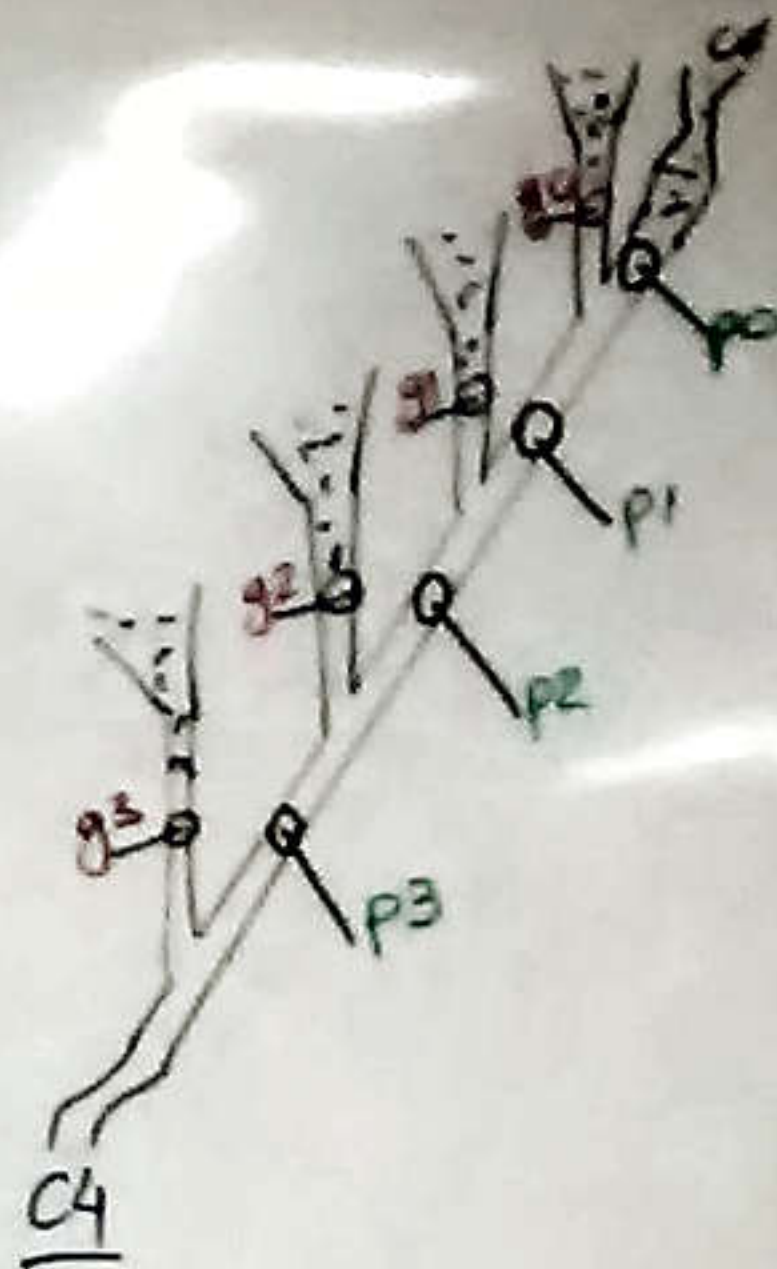
$$= g_1 + p_1 \cdot g_0 + p_1 \cdot p_0 \cdot e_0$$

$$c_3 = g_2 + p_2 \cdot c_2$$

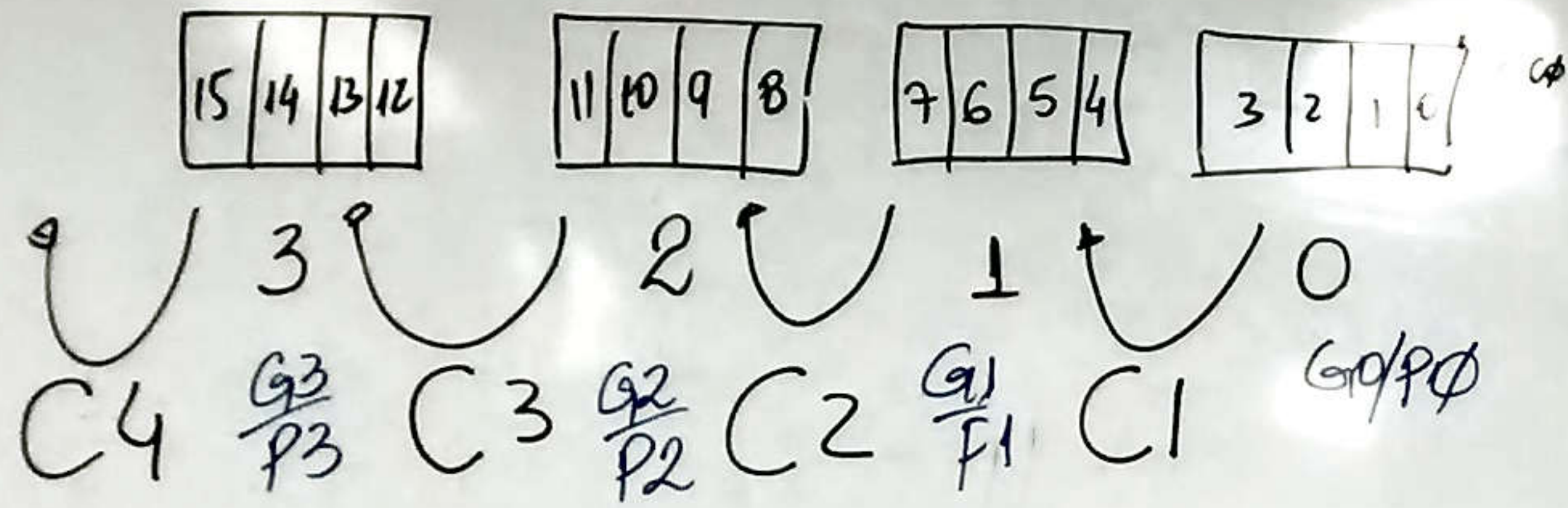
$$= g_2 + p_2 \cdot g_1 + p_2 \cdot p_1 \cdot g_0 + p_2 \cdot p_1 \cdot p_0 \cdot e_0$$

$$c_4 = g_3 + p_3 \cdot c_3$$

$$c_4 = g_3 + p_3 \cdot g_2 + p_3 \cdot p_2 \cdot g_1 + p_3 \cdot p_2 \cdot p_1 \cdot g_0 + p_3 \cdot p_2 \cdot p_1 \cdot p_0 \cdot e_0$$



2⁹ abstraction \Rightarrow 16 bits



$$P_0 = p_3 \cdot p_2 \cdot p_1 \cdot p_0$$

$$P_1 = p_7 \cdot p_6 \cdot p_5 \cdot p_4$$

$$P_2 = p_{11} \cdot p_{10} \cdot p_9 \cdot p_8$$

$$P_3 = p_{15} \cdot p_{14} \cdot p_{13} \cdot p_{12}$$

$$G_0 = g_3 + p_3 \cdot g_2 + p_3 \cdot p_2 \cdot g_1 + p_3 \cdot p_2 \cdot p_1 \cdot g_0$$

$$G_1 = g_7 + p_7 \cdot g_6 + p_7 \cdot p_6 \cdot g_5 + p_7 \cdot p_6 \cdot p_5 \cdot g_4$$

$$G_2 = g_{11} + p_{11} \cdot g_{10} + p_{11} \cdot p_{10} \cdot g_9 + p_{11} \cdot p_{10} \cdot p_9 \cdot g_8$$

$$G_3 = g_{15} + p_{15} \cdot g_{14} + p_{15} \cdot p_{14} \cdot g_{13} + p_{15} \cdot p_{14} \cdot p_{13} \cdot g_{12}$$

$$C_1 = G_0 + P_0 \cdot c_0$$

$$C_2 = G_1 + P_1 C_1$$

$$= G_1 + P_1 G_0 + P_1 P_0 c_0$$

$$C_3 = G_2 + P_2 C_2$$

$$= G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 c_0$$

$$C_4 = G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0$$

$$+ P_3 P_2 P_1 P_0 c_0$$

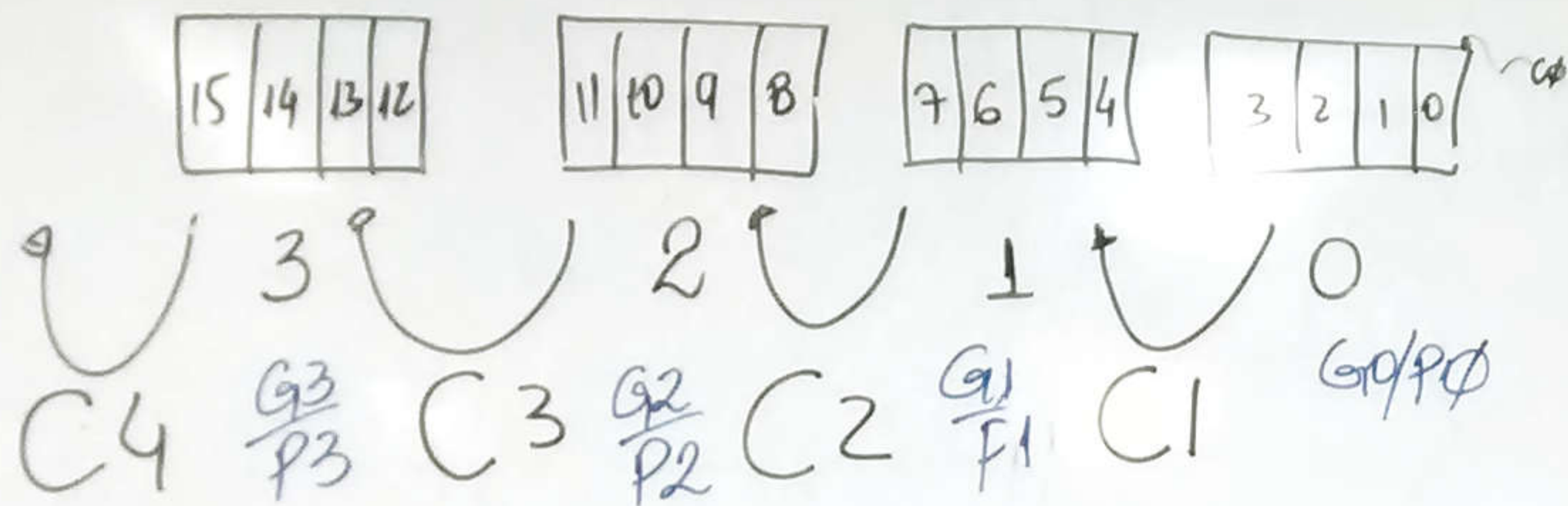
947A +
755D

847A
755D

Haverá vai1 para
fora do num? SIM

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	0	0	1	0	1	0	0	0	1	1	1	1	0	1	0
	0	1	1	1	0	1	0	1	0	1	0	1	1	1	0	1
$\phi(+)$	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1
$g(.)$	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	0

2⁹ abstraction => 16 bits



$$\downarrow P_0 = p_3 \cdot p_2 \cdot p_1 \cdot p_0$$

$$\downarrow P_1 = p_7 \cdot p_6 \cdot p_5 \cdot p_4$$

$$\downarrow P_2 = p_{11} \cdot p_{10} \cdot p_9 \cdot p_8$$

$$\downarrow P_3 = p_{15} \cdot p_{14} \cdot p_{13} \cdot p_{12}$$

$$\downarrow G_0 = g_3 + p_3 \cdot g_2 + p_3 \cdot p_2 \cdot g_1 + p_3 \cdot p_2 \cdot p_1 \cdot g_0$$

$$\downarrow G_1 = g_7 + p_7 \cdot g_6 + p_7 \cdot p_6 \cdot g_5 + p_7 \cdot p_6 \cdot p_5 \cdot g_4$$

$$\downarrow G_2 = g_{11} + p_{11} \cdot g_{10} + p_{11} \cdot p_{10} \cdot g_9 + p_{11} \cdot p_{10} \cdot p_9 \cdot g_8$$

$$\downarrow G_3 = g_{15} + p_{15} \cdot g_{14} + p_{15} \cdot p_{14} \cdot g_{13} + p_{15} \cdot p_{14} \cdot p_{13} \cdot g_{12}$$

$$C_1 = G_0 + P_0 \cdot c_0$$

$$C_2 = G_1 + P_1 C_1$$

$$= G_1 + P_1 G_0 + P_1 P_0 c_0$$

$$C_3 = G_2 + P_2 C_2$$

$$= G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 c_0$$

$$C_4 = G_3 + P_3 G_2 + P_3 P_2 G_1 + P_3 P_2 P_1 G_0$$

$$+ P_3 P_2 P_1 P_0 c_0$$