

15 Dissenyeu un comptador de sincrònic reversible en mòdul 12.

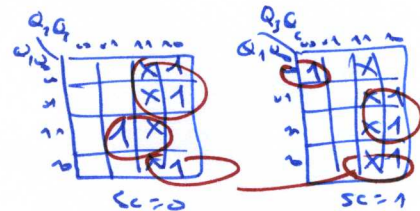
Treue que començaria amb el 0 i ha de ser reversible en
sentit de l'entitat. $2^3 < 12 < 2^4 \rightarrow 4 \text{ FF's}$

SC \rightarrow vector de 4 bits
 \rightarrow amb 2 ones i 2 zeros

al 0

	SC	Q ₃	Q ₂	Q ₁	Q ₀	Q ₃ ⁺	Q ₂ ⁺	Q ₁ ⁺	Q ₀ ⁺
0	0	0	0	0	0	0	0	0	1
1	0	0	0	0	0	0	0	1	0
2	0	0	0	0	0	0	0	1	1
3	0	0	0	0	0	0	0	1	0
4	0	0	0	1	0	0	1	0	1
5	0	0	0	1	0	0	1	1	0
6	0	0	0	1	1	0	1	1	1
7	0	0	0	1	1	1	0	0	0
8	0	1	0	0	0	1	0	0	1
9	0	1	0	0	1	1	0	1	0
10	0	1	0	1	0	1	0	1	1
11	0	1	0	1	1	0	0	0	0
12	0	1	1	0	0	x	x	x	x
13	0	1	1	0	1	x	x	x	x
14	0	1	1	1	0	x	x	x	x
15	0	1	1	1	1	x	x	x	x
16	1	0	0	0	0	1	0	1	1
17	1	0	0	0	1	0	0	0	0
18	1	0	0	1	0	0	0	0	1
19	1	0	0	1	1	0	0	1	0
20	1	0	1	0	0	0	1	0	0
21	1	0	1	0	1	0	1	0	1
22	1	0	1	1	0	0	1	1	0
23	1	0	1	1	1	0	1	1	1
24	1	1	0	0	0	1	0	0	0
25	1	1	0	0	1	1	0	0	1
26	1	1	0	1	0	1	0	1	0
27	1	1	0	1	1	1	0	1	1
28	1	1	1	0	0	x	x	x	x
29	1	1	1	0	1	x	x	x	x
30	1	1	1	1	0	x	x	x	x
31	1	1	1	1	1	x	x	x	x

al 1



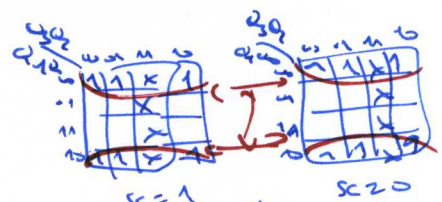
D₃

$$D_3 = \overline{SC} Q_3 \overline{Q_1} + \overline{SC} Q_2 Q_1 Q_0 + Q_3 Q_1 \overline{Q_0} + SC Q_3 Q_0 + SC \overline{Q_3} \overline{Q_1} \overline{Q_0}$$

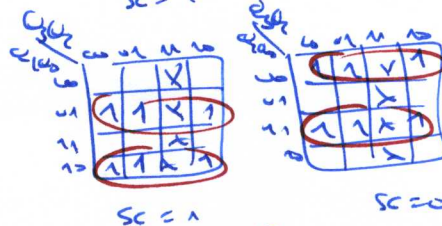
$$D_2 = \overline{SC} \overline{Q_3} \overline{Q_2} Q_1 \overline{Q_0} + \overline{SC} Q_2 \overline{Q_1} + Q_3 Q_1 \overline{Q_0} + SC Q_2 Q_0 + SC Q_3 \overline{Q_1} \overline{Q_0}$$

$$D_1 = \overline{SC} \overline{Q_1} Q_0 + \overline{SC} Q_1 \overline{Q_0} = \overline{SC} (Q_1 \oplus Q_0) + SC (Q_1 \oplus Q_0)$$

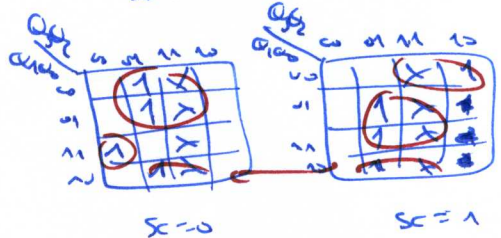
$$D_0 = \overline{Q_0}$$



D₂

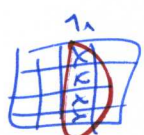


D₁



D₀

Si queia amb la funció de 4 bits addicionals



$$f = Q_3 Q_2 \text{ (la funció de 4 bits)}$$