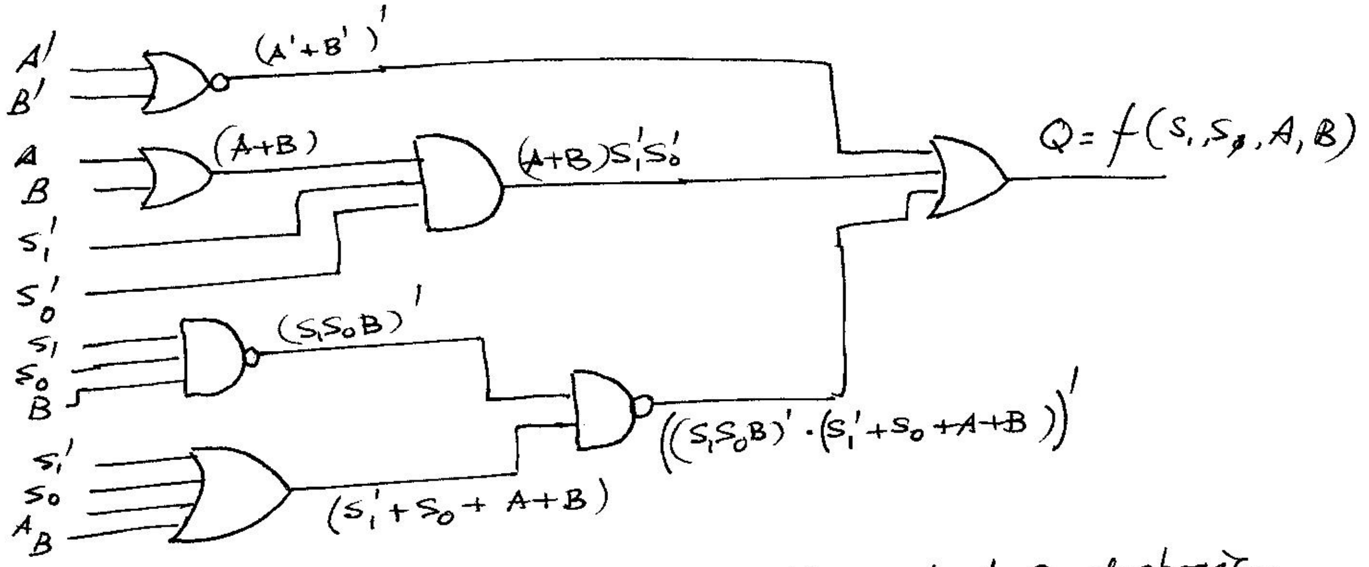
* Circuit 1B to be analysed



So, analysing gate by gate we produce the output Q algebraic equation, which carries the same informations as the schematic

$$Q = f(S_1, S_0, A, B) = (A'+B')' + (A+B)S_1'S_0' + \left((S_1S_0B)' \cdot (S_1'+S_0+A+B) \right)'$$

So now, let's try to operate the expression to find a SoP or a PoS. Let's operate (simplify) first the big brakets:

$(A'+B')' = A'' \cdot B'' = AB$ ← a simple product

$(A+B)S_1'S_0' = S_1'S_0'A + S_1'S_0'B$ (Two products)

$(S_1S_0B)'' + (S_1'+S_0+A+B)' = S_1S_0B + \underbrace{S_1 \cdot S_0'A'B'}_{\to \text{a minterm!}}$

Finally:

$$Q = AB + S_1'S_0'B + S_1'S_0'A + S_1S_0B + S_1S_0'A'B' \quad (SoP)$$

So, now let's generate the sum of minterms, which happens to be all the terms '1' in the truth table. Let's add the missing variables term by term:

$$AB = AB(S_1+S_1') = ABS_1 + ABS_1'$$

$$S_1S_0AB + S_1S_0'AB \qquad S_1'S_0AB + S_1'S_0'AB$$

$$m_{1111} + m_{1011} + m_{0111} + m_{0011}$$

$$m_{15} + m_{11} + m_7 + m_3$$

$$S_1'S_0'B = S_1'S_0'AB + S_1'S_0'A'B = m_{0011} + m_{0001}$$
$$\qquad\qquad\qquad\qquad\qquad\qquad m_3 \quad m_1$$

$$S_1'S_0'A \to \begin{cases} S_1'S_0'AB \to m_{0011} & m_3 \\ S_1'S_0'AB' \to m_{0010} & m_2 \end{cases}$$

$$S_1S_0B = S_1S_0AB + S_1S_0A'B = m_{1111} + m_{1101}$$
$$\hookrightarrow S_1S_0(A+A')B$$
$$m_{15} + m_{13}$$

$$S_1S_0'A'B' = m_{1000} \to m_8$$

In this way:

$$Q = f(S_1, S_0, A, B) = \sum_4 m(1, 2, 3, 7, 8, 11, 13, 15)$$

and also:

$$= \prod_4 M(0, 4, 5, 6, 9, 10, 12, 14)$$

and the truth table is the same informations, or the <u>karnaugh map</u>:

S_1	S_0	A	B	Q
0	0	0	0	Ø
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

S_1S_0 \ AB	ØØ	Ø1	11	1Ø
ØØ	Ø (Ø)	1 (1)	1 (3)	1 (2)
Ø1	Ø (4)	Ø (5)	1 (7)	Ø (6)
11	Ø (12)	1 (13)	1 (15)	Ø (14)
1Ø	1 (8)	Ø (9)	1 (11)	Ø (10)

we are not going to use it. Instead, we'll <u>minimise</u> functions using software like <u>minilog.exe</u>