# Corrigé TD Electronique n° 1

## Algèbre de Boole – Logique Combinatoire 1

TD1
Logique Combinatoire 1

**1** a) $S = \overset{1}{P_L \cdot P_p} + \overset{2}{\overline{P_L} \cdot \overline{P_p}} + \overset{3}{\overline{P_L} \cdot P_p}$ (*)

b) b₁) avant de câbler il faut simplifier la fonction logique → pour avoir le moins de circuits logiques possib.

$S = \underbrace{P_L \cdot P_p + \overline{P_L} \cdot P_p}_{1+3} + \underbrace{\overline{P_L} \cdot \overline{P_p}}_{2}$

$1+3 = P_p \cdot \overbrace{(P_L + \overline{P_L})}^{1} = P_p$

or une fonction logique n'est pas changée si on rajoute un terme déjà existant. (car: $a + a = a$) → $S = \overset{1}{P_L \cdot P_p} + \overset{2}{\overline{P_L} \cdot \overline{P_p}} + \overset{3}{\overline{P_L} \cdot P_p} + \overset{3}{\overline{P_L}\,P_p}$

rajoutons 3 à 2

$2 + 3 = \overline{P_L} \cdot \overline{P_p} + \overline{P_L} \cdot P_p = \overline{P_L} \cdot (P_p + \overline{P_p}) = \overline{P_L}$

→ $S = P_p + \overline{P_L}$

autre façon de simplifier algéb.

$S = \overline{P_L} + P_L P_p$

$S = \overline{\overline{S}} = \overline{\overline{\overline{P_L} + P_L P_p}}$

$= \overline{P_L \cdot (\overline{P_L} + \overline{P_p})}$

$= \overline{P_L \cdot \overline{P_p}}$

$\boxed{S = P_p + \overline{P_L}}$

b₂)

| $P_p \backslash P_L$ | 0 | 1 |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 1 | 1 |

→ $\overline{P_L}$

→ $P_p$

→ $S = \overline{P_L} + P_p$

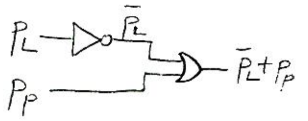
si on regroupe les 0 : (→ $\overline{S}$ obtenue)

| $P_p \backslash P_L$ | 0 | 1 |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 1 | 1 |

→ $\overline{S} = P_L \cdot \overline{P_p}$

→ $S = \overline{P_L \cdot \overline{P_p}} = \overline{P_L} + P_p$

c)



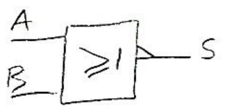

⚠ dans les tableaux de Karnaugh à 2 variables, les coins ne constituent pas des cases adjacentes comme pour les tableaux de Karnaugh d'ordre supérieur

| $P_p \backslash P_L$ | 0 | 1 |
|---|---|---|
| 0 | ① | |
| 1 | | ② |

cases ① et ② non adjacentes.

**2**. a) $f = A \text{ NOR } B$ car $f = \overline{(A+B)} = \overline{A} \cdot \overline{B}$ on peut le voir avec la table de vérité (ou mieux Karnaugh pr simplification)

b)




| A | B | $S = \overline{A+B}$ |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

| $B \backslash A$ | 0 | 1 |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 0 | 0 |

$S = \overline{A} \cdot \overline{B} = \overline{A+B}$

(*) $S = P_L P_p + \overline{P_L}$ (non simplifié)

→ $S = P_L P_p + \overline{P_L} \cdot P_p + \overline{P_L} \cdot \overline{P_p}$ (idempotence)

→ $S = P_L P_p + \overline{P_L} P_p + \overline{P_L}\,\overline{P_p} + \overline{P_L} \cdot P_p = \underbrace{\overline{P_L} + P_p}$

on a aussi : $\overline{S} = P_L \cdot \overline{P_p} \rightarrow S = \underbrace{\overline{P_L} + P_p}$

simplifié

## 4

a) $S = \overline{C \oplus D} = CD + \bar{C}.\bar{D}$ (fonction coïncidence)

| $AB \backslash CD$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 0 | 1 | 0 |
| 01 | 1 | 0 | 1 | 0 |
| 11 | X | X | X | X |
| 10 | 1 | 0 | X | X |

$S = \bar{C}\bar{D} + CD$

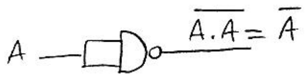
b) $\bar{S} = C \oplus D$

| $AB \backslash CD$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 0 | 1 | 0 |
| 01 | 1 | 0 | 1 | 0 |
| 11 | X | X | X | X |
| 10 | 1 | 0 | X | X |

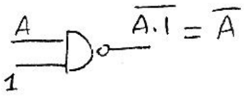
$\bar{S} = \bar{C}D + C\bar{D}$

## 3

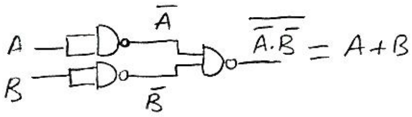
a) NOT : $A \rightarrow \bar{A}$ :



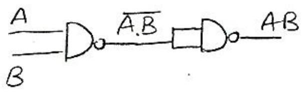

ou



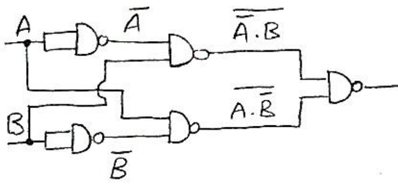

b) OR : $A, B \rightarrow A+B$ :




c) AND : $A, B \rightarrow A.B$ :

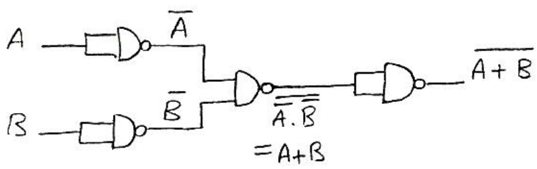



d) XOR : $A, B \rightarrow A \oplus B = A.\bar{B} + \bar{A}.B$




$\overline{(A+\bar{B}).(\bar{A}+B)}$
$= \overline{(A+\bar{B})} + \overline{(\bar{A}+B)}$
$= \bar{A}.B + A.\bar{B}$

e) NOR : $A, B \rightarrow \overline{A+B}$




ou : $\bar{A}.\bar{B}$