

### Exo1.

#### 1) Classements

$$5000 \text{ Kb} > 2 \text{ Mb} > 7200 \text{ b} > 7 \text{ Kb} > 200 \text{ b} > 1000 \text{ b} \quad (1 \text{ p})$$

2) Nombre d'octet nécessaire pour 16 384 objets.

$$\text{Nb\_bits} = \log_2 (16\,384)$$

$$= 14 \text{ bits}$$

donc 2 b.

(1 p)

3) Espace nécessaire pour stocker les 16 384 objets.

$$\text{Espace\_nécessaire} = \text{taille\_code} \times \text{Nb\_code}$$

$$= 2 \times 16\,384$$

$$= 32\,768 \text{ b}$$

$$= 32 \text{ Kb}$$

(0,5 p)

Donc la clé USB est suffisante pour stocker les 16 384 objets.

4) Conversion des bases: 0 1 B D 9 C

a)  $(01BD9C)_{16} = (\underbrace{0000}_0 \underbrace{0001}_1 \underbrace{1011}_B \underbrace{1101}_D \underbrace{1001}_9 \underbrace{1100}_C)_2 \quad \text{--- (0,5 p)}$

$$= 2^1 + 2^3 + 2^4 + 2^7 + 2^8 + 2^{10} + 2^{11} + 2^{12} + 2^{13} + 2^{15}$$

$$= 4 + 8 + 16 + 128 + 256 + 1024 + 2048 + 4096 + 8192 + 32768$$

$$= (48\,540)_{10}$$

--- (0,5 p)

b)

$$(\underline{011} \underline{101} \underline{100} \underline{111})_2 = (3547)_8 \quad \text{--- (0,5 p)}$$

$$(\underline{111} \underline{0110} \underline{0111})_2 = (767)_{16} \quad \text{--- (0,5 p)}$$

①

### Exo 2:

$$A = -25$$

$$B = -85$$

1) Codage de A et B en SVA et Ca2.

Division successive. — (5p)

$$\left. \begin{aligned} A &= -(0100\ 0001)_2 = (1100\ 0001)_{SVA} \\ B &= (0101\ 0101)_2 = (1101\ 0101)_{SVA} \end{aligned} \right\} 0,5$$

$$A = (1011\ 1110)_{Ca1} + 1 = (1011\ 1111)_{Ca2} \quad \text{--- } 0,5$$

$$B = (1010\ 1010)_{Ca1} + 1 = (1010\ 1011)_{Ca2} \quad \text{--- } 0,5$$

2) Calcul de A + B

$$\begin{array}{r} \textcircled{1} 1011 \quad 1111 \quad \leftarrow 0,5 \\ + 1010 \quad 1011 \end{array}$$

$$\hline 0110 \quad 1010$$

← déplacement de capacité. —  $\textcircled{0,5}$

3) Codage de -B

$$-B = (1101\ 0101)_{Ca2} \quad \text{--- } 0,25$$

Calcul de A + (-B)

$$\begin{array}{r} \textcircled{1} 1011 \quad 1111 \quad \leftarrow 0,5 \\ + 0101 \quad 0101 \end{array}$$

$$\hline 0001 \quad 0100$$

← résultat valide. —  $\textcircled{0,25}$

②



Ex 2.03:

1) Table de vérité:

a	b	c	d	f(a,b,c,d)
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

(1p)

2) 1<sup>re</sup> forme canonique:

$$f(a,b,c,d) = \underbrace{\bar{a}\bar{b}\bar{c}\bar{d}}_{m_0} + \underbrace{\bar{a}\bar{b}\bar{c}d}_{m_1} + \underbrace{\bar{a}\bar{b}c\bar{d}}_{m_2} + \underbrace{\bar{a}b\bar{c}\bar{d}}_{m_4} + \underbrace{\bar{a}b\bar{c}d}_{m_5} + \underbrace{\bar{a}b\bar{c}d}_{m_9} + \underbrace{\bar{a}b\bar{c}d}_{m_{11}} + \underbrace{abcd}_{m_{15}}$$

b) 2<sup>me</sup> forme canonique:

$$f(a,b,c,d) = (a+b+\bar{c}+\bar{d}) \cdot (a+\bar{b}+c+\bar{d}) \cdot (a+\bar{b}+\bar{c}+d) \cdot (\bar{a}+b+c+d) \cdot (\bar{a}+b+\bar{c}+d) \cdot (\bar{a}+\bar{b}+c+d) \cdot (\bar{a}+\bar{b}+\bar{c}+d)$$

3) simplification algébrique:

$$\begin{aligned} f &= (m_0 + m_2) + (m_0 + m_4) + (m_1 + m_5) + (m_2 + m_{15}) + (m_{11} + m_{15}) \\ &= \bar{a}\bar{b}\bar{d} + \bar{a}\bar{c}\bar{d} + \bar{b}\bar{c}d + acd + bcd \\ &= \bar{a}\bar{d}(\bar{b}+\bar{c}) + d(\bar{b}\bar{c} + bc + ac) \\ &= \bar{a}\bar{d}(\bar{b}+\bar{c}) + d((\bar{b} \oplus c) + ac) \end{aligned}$$

4) simplification Karnaugh:

cd \ ab	00	01	11	10
00	1	1	0	1
01	1	0	1	0
11	0	0	1	0
10	0	1	1	0

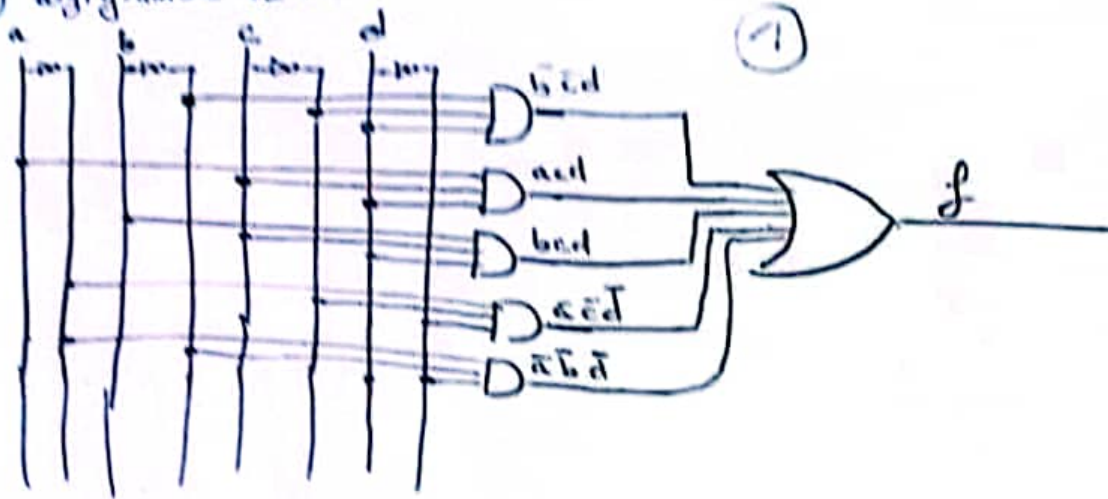
$$f = \bar{b}\bar{c}d + acd + bcd + \bar{a}\bar{c}\bar{d} + \bar{a}\bar{b}\bar{d}$$

$$f = \bar{a}\bar{d} + \bar{b}\bar{c}d + bcd + \bar{a}\bar{b}\bar{c}d$$

$$f = (\bar{a}\bar{d}) \cdot (\bar{b}+c+\bar{d}) \cdot (\bar{b}+\bar{c}+d) \cdot (a+b+\bar{c})$$

(3)

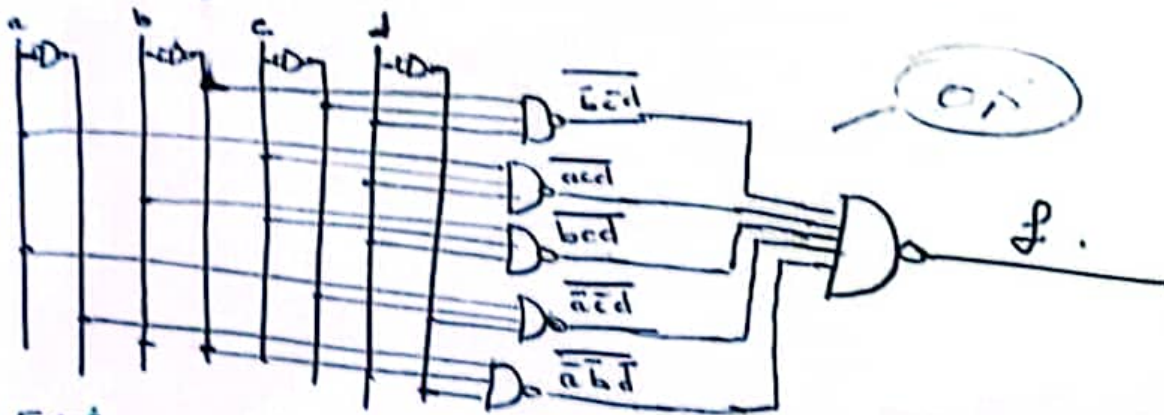
7) Logigramme de F.



8) Logigramme de F avec des portes NAND uniquement.

$$F = \overline{b} \overline{c} d + a c d + b c d + \overline{a} \overline{c} \overline{d} + \overline{a} \overline{b} \overline{d}$$

$$= \overline{b} \overline{c} d \cdot \overline{a} \overline{c} \overline{d} \cdot \overline{a} \overline{b} \overline{d}$$



Exo 8:

$$f_1 = \overline{A} B C + \overline{A} \cdot C + A \overline{D}$$

$$f_2 = A \overline{D} + \overline{B} \overline{D}$$

$$f_3 = B \overline{C} \overline{D} + \overline{A} \overline{D}$$

④