Tlemcen University
Faculty of Sciences
Mathematics Department

Check Exam
Machine Framework1
S2-L1-M-MI

10 june 2024
1h30

Exercise 1 (5 points). *Let us consider an integer a.*
(On considère un entier naturel a.)

1. *Use the Newton's Binomial Theorem to develop $(a+1)^5$.*
   (Développer $(a+1)^5$, en utilisant le théorème du binôme de Newton.)
2. *Deduce the numerical representation of the fifth power of thirteen in the radix twelve representation. (En déduire la représentation chiffrée de 13^5 en base douze.)*

Exercise 2 (7 points).

1. *Encode in UTF-8 the Hebrew character* ℵ *(Aleph) of Unicode code. $U+2135$, follow this instructions.*
   (Encoder le caractère Hebreu ℵ *(Aleph) en UTF-8 de code Unicode $U+2135$, en suivant les instructions.)*
   (a) *Convert* 2135 *to binary. (Convertir* 2135 *en binaire.)*
   (b) *Determine the number of significant bits. (Déterminer le nombre de bits significatifs.)*
   (c) *Choose a design. (Choisir un modèle.)*
   (d) *Give the binary code. (Donner le code binaire.)*
   (e) *Convert this code to hexadecimal. (Convertir en hexadécimal.)*
2. *Determine the Unicode code of the UTF-8 encoded character in hexadecimal C2A3.*
   (Déterminer le code Unicode du caractère codé en UTF-8 hexadécimal C2A3.)

Exercise 3 (8 points). *Let f be a boolean function defined by the truth table bellow. (Soit f une fonction booléenne définie par la table de vérité ci dessous.)*

Tlemcen University
Faculty of Sciences
Mathematics Department

Check Exam
Machine Framework1
S2-L1-M-MI

10 june 2024
1h30

x	y	z	$f(x,y,z)$
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

1. *Represent f by his disjunctive canonical form. (First canonical form) (Donner la forme canonique disjonctive de f (La première forme canonique))*
2. *Use the algebric simplification to obtain the simplified expression of f. (Simplifier f algébriquement.)*
3. *Implement the logical function f, using only 2-input NAND gates. (Tracer le logigramme de f en utilisant des portes NAND à deux entrées.)*

Bon courage

Exercise 1:

1) $(a+1)^5 \overset{01}{=} C_5^0 a^5 + C_5^1 a^4 + C_5^2 a^3 + C_5^3 a^2 + C_5^4 a^1 + C_5^5 a^0$

$\overset{01}{=} a^5 + 5a^4 + 10a^3 + 10a^2 + 5a^1 + 1a^0$

$= a^5 + 5a^4 + 10a^3 + 10a^2 + 5a + 1.$ 01

2) $13^5 \underset{01}{=} (12+1)^5 + 1.12^5 + 5.12^4 + 10.12^3 + 10.12^2 + 5.12^1 + 1.12^0 = (15AA51)_{12}$; $A = 10$

01

Exercise 2:

N : 2135

1) (a) 2135 = 0010000100110101. 01

(b) There are 14 significant bits. 01

(c) 1110xxxx 10xxxxxx 10xxxxxx 01

(d) 111000101000010010110101 01

(e) E284B5. 01

2) C2A3 = $\underbrace{11000010}\underbrace{10100011}$

we have a character of two bytes

the significant bits are: 10100011 01

the Unicode code is U+00A3. 01

Exercise 3:

$0\,1$

1/ $f(x,y,z) = \bar{x}\bar{y}z + x\bar{y}\bar{z} + x\bar{y}\cdot z + xyz$

2/ $f(x,y,z) = \bar{x}\bar{y}z + x\bar{y}(\underbrace{\bar{z}+z}_{1}) + xyz$

$= \bar{x}\bar{y}z + x\bar{y} + xyz.$

$\cancel{= \bar{x}\bar{y}z +}\; = \bar{y}(x + \bar{x}z) + xyz.$

$= \bar{y}(x+z) + xyz.$

$= x\bar{y} + \bar{y}z + xyz = \bar{y}z + x(\bar{y} + yz)$

$= \bar{y}z + x(\bar{y}+z) = x\bar{y} + xz + \bar{y}\cdot z$ $0\,2$

3/ $f(x,y,z) = \overline{\overline{x\bar{y} + xz + \bar{y}z}}$ $0{,}5$

$= \overline{\overline{x\bar{y}}\cdot\overline{xz}\cdot\overline{\bar{y}z}}$ $0{,}5$

$= \overline{\overline{x\overline{yy}}\cdot\overline{xz}\cdot\overline{\overline{yy}\cdot z}}$ $0{,}5$

$= \overline{\overline{\overline{\overline{x\overline{yy}}\cdot\overline{xz}}}\cdot\overline{\overline{yy}\cdot z}}$ $0{,}5$

$$= \overline{\overline{\overline{x\,\overline{yy}\cdot\overline{xz}}\cdot\overline{x\,\overline{yy}\cdot\overline{xz}}}\cdot\overline{\overline{\overline{yy}}\cdot z}}$$

0,5

0 2