UNIVERSIDAD AUTONOMA DE AGUASCALIENTES

Centro de Ciencias Básicas

Materia: **Lógica Digital**

TAREA 1

Parcial I

Ingeniería en Computación Inteligente - Semestre 2° A

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TAREA 1 LOGICA DIGITAL

① Suma binaria $7+7+7$ $\quad 7 = 111$

7	111
+7	+111
7	111
21	10101

② Realizar la operación 11111×1101.

$$
\begin{array}{r}
11111 \\
\times\ 1101 \\
\hline
11111 \\
00000 \\
11111 \\
11111 \\
\hline
011
\end{array}
$$

③ Convertir los siguientes números binarios a sus equivalentes decimales

a) $00\,1\,1\,00 = 1(2)^2 + 1(2)^3 = 4+8 = 12$

b) $000011 = 1(2)^0 + 1(2)^1 = 1+2 = 3$

c) $011100 = 1(2)^2 + 1(2)^3 + 1(2)^4 = 28$

d) $111100 = 1(2)^2 + 1(2)^3 + 1(2)^4 + 1(2)^5 = 60$

e) $101010 = 1(2)^1 + 1(2)^3 + 1(2)^5 = 42$

f) $111111 = 1(2)^0 + 1(2)^1 + 1(2)^2 + 1(2)^3 + 1(2)^4 + 1(2)^5 = 63$

g) $100001 = 1(2)^0 + 1(2)^5 = 33$

h) $111000 = 1(2)^3 + 1(2)^4 + 1(2)^5 = 56$

i) $111100001111 = 1(2)^0 + 1(2)^1 + 1(2)^2 + 1(2)^3 + 1(2)^8 + 1(2)^9 + 1(2)^{10} + 1(2)^{11} = 3855$

j) $11100.011 = 1(2)^2 + 1(2)^3 + 1(2)^4 + \frac{1}{4} + \frac{1}{8} = 28.375$

K) $110011.10011 = 1(2)^0 + 1(2)^1 + 1(2)^4 + 1(2)^5 + \frac{1}{2} + \frac{1}{16} + \frac{1}{32} = 51.59375$

l) $1010101010.1 = 1(2)^1 + 1(2)^3 + 1(2)^5 + 1(2)^7 + 1(2)^9 + \frac{1}{2} = 682.5$

④ Convertir los siguientes números decimales a sus equivalentes binarios

a) 64 = 01000000

2 | 64
2 | 32 → 0
2 | 16 → 0
2 | 8 → 0
2 | 4 → 0
2 | 2 → 0
2 | 1 → 1
0 → 0

b) 100 = 01100100

2 | 100
2 | 50 → 0
2 | 25 → 0
2 | 12 → 1
2 | 6 → 0
2 | 3 → 0
2 | 1 → 1
2 | 0 → 1
0 → 0

c) 111 = 01101111

2 | 111
2 | 55 → 1
2 | 27 → 1
2 | 13 → 1
2 | 6 → 1
2 | 3 → 0
2 | 1 → 1
2 | 0 → 1
0 → 0

d) 145 = 010010001

2 | 145
2 | 72 → 1
2 | 36 → 0
2 | 18 → 0
2 | 9 → 0
2 | 4 → 1
2 | 2 → 0
2 | 1 → 0
2 | 0 → 1
0 → 0

e) 255 = 011111111

2 | 255
2 | 127 → 1
2 | 63 → 1
2 | 31 → 1
2 | 15 → 1
2 | 7 → 1
2 | 3 → 1
2 | 1 → 1
2 | 0 → 1
0 → 0

f) 500 = 0111110100

2 | 500
2 | 250 → 0
2 | 125 → 0
2 | 62 → 1
2 | 31 → 0
2 | 15 → 1
2 | 7 → 1
2 | 3 → 1
2 | 1 → 1
2 | 0 → 1
0

g) 34.75 = 0100010.110

2 | 34
2 | 17 → 0
2 | 8 → 1
2 | 4 → 0
2 | 2 → 0
2 | 1 → 0
2 | 0 → 1
0 →

.75
x 2
1.50 → 1

.50
x 2
1.00 →

0.00
x 2
0 → 0

(h) 25.25 = 0110001.010

2 | 25	
2 | 12	→ 1
2 | 6	→ 0
2 | 3	→ 0
2 | 1	→ 1
2 | 0	→ 1
	0 → 0

.25 × 2 = 0.50 → 0

0.50 × 2 = 1.00 → 1

0.00 × 2 = 0 → 0

(i) 27.1875 = 011011.00110

2 | 27	
2 | 13	→ 1
2 | 6	→ 1
2 | 3	→ 0
2 | 1	→ 1
2 | 0	→ 1
	0 → 0

(j) 23.1 = 010111.000110

2 | 23	
2 | 11	→ 1
2 | 5	→ 1
2 | 2	→ 1
2 | 1	→ 0
2 | 0	→ 1
	0 → 0

0.1 × 2 = 0.2 → 0

0.2 × 2 = 0.4 → 0

0.4 × 2 = 0.8 → 0

0.8 × 2 = 1.6 → 1

0.6 × 2 = 1.2 → 1

0.2 × 2 = 0.4 → 0

⑤ Convertir los números $(AF315)_{16}$ y $(7326)_8$ a base 10 y base 2

$(AF315)_{16} = (A)(16)^4 + F(16)^3 + 3(16)^2 + 1(16)^1 + 5(16)^0$

$= 10(16)^4 + 15(16)^3 + 3(16)^2 + 1(16)^1 + 5(16)^0$

$= 655360 + 61440 + 768 + 16 + 5 = (717589)_{10}$

$(7326)_8 = (7)(8)^3 + 3(8)^2 + (2)(8)^1 + (6)(8)^0$

$= 3584 + 192 + 16 + 6 = (3798)_{10}$

$(AF315)_{16} = (1010\,1111\,0011\,0001\,0101)_2$

A = 1010
F = 1111
3 = 0011
1 = 0001
5 = 0101

$(7326)_8 = (111\,011\,010\,110)_2$ *

7 = 111
3 = 011
2 = 010
6 = 110

⑥ Convertir los números $(245.625)_{10}$ y $(1797.223)_{10}$ a binario, octal y decimal.

2 | 245	$122 + 1 = a_0$	
2 | 122	$61 + 0 = a_1$	
2 | 61	$30 + 1 = a_2$	
2 | 30	$15 + 0 = a_3$	
2 | 15	$7 + 1 = a_4$	
2 | 7	$3 + 1 = a_5$	
2 | 3	$1 + 1 = a_6$	
2 | 1	$0 + 1 = a_7$	

.625 × 2 = 1.25 = 1

0.25 × 2 = 0.50 = 0

0.5 × 2 = 1.00 = 1

0.00 × 2 = 0.00 = 0

1111 0101 . 1010

Octal

245.625 → 8

$8\overline{)245} = 30 + 5$

$8\overline{)30} = 3 + 6$

$8\overline{)3} = 0 + 3$

$$\begin{array}{r} 0.625 \\ \times \quad 8 \\ \hline 5 \end{array} = .5$$

365.5_8

Hexadecimal

245.625 → 16

$16\overline{)245} = 15 + 5 = 5$

$16\overline{)15} = 0 + 15 = F$

$$\begin{array}{r} .625 \\ \times \quad 16 \\ \hline 0.10 \end{array} = .A$$

$F5.A_{16}$

binario 1797.223_{10}

$2\overline{)1797} = 898 + 1$

$2\overline{)898} = 449 + 0$

$2\overline{)449} = 224 + 1$

$2\overline{)224} = 112 + 0$

$2\overline{)112} = 56 + 0$

$2\overline{)56} = 28 + 0$

$2\overline{)28} = 14 + 0$

$2\overline{)14} = 7 + 0$

$2\overline{)7} = 3 + 1$

$2\overline{)3} = 1 + 1$

$2\overline{)1} = 0 + 1$

$2\overline{)0} = 0 + 0$

$$\begin{array}{r} .223 \\ \times \quad 2 \\ \hline 0.446 \end{array} = 0 \qquad \begin{array}{r} .446 \\ \times \quad 2 \\ \hline 0.892 \end{array} = 0 \qquad \begin{array}{r} .892 \\ \times \quad 2 \\ \hline 1.784 \end{array} = 0$$

$$\begin{array}{r} .784 \\ \times \quad 2 \\ \hline 1.568 \end{array} = 1 \qquad \begin{array}{r} .568 \\ \times \quad 2 \\ \hline 1.136 \end{array} = 1 \qquad \begin{array}{r} 0.136 \\ \times \quad 2 \\ \hline 0.272 \end{array} = 0$$

$$\begin{array}{r} .272 \\ \times \quad 2 \\ \hline 0.544 \end{array} = 0 \qquad \begin{array}{r} .544 \\ \times \quad 2 \\ \hline 1.088 \end{array} = 1$$

11011110011.00111

Octal

1797.223 ⟶ 8

$8\overline{)1797} = 224 + 5$

$8\overline{)224} = 28 + 0$

$8\overline{)28} = 3 + 4$

$8\overline{)3} = 0 + 3$

.223 × 8 = 1.784 = 1

1.784 × 8 = 6.272 = 6

6.272 × 8 = 2.176 = 2

2.176 × 8 = 1.408 = 1

3405.1621

hexadecimal

$16\overline{)1797} = 1215 = 5$

$16\overline{)112} = 7 + 0 = 0$

$16\overline{)7} = 0 + 7 = 7$

.223 × 16 = 3.568 = 3

3.568 × 16 = 9.104 = 9

9.104 × 16 = 1.664 = 1

705.391

⑦ Convertir el número $(18AF7)_{16}$ a binario, octal y decimal.

$(18AF7)_{16} = (0001\,1000\,1010\,1111\,0111)_2$

1 = 0001
8 = 1000
A = 1010
F = 1111
7 = 0111

$(18AF7)_{16} = (0001\ 1000\ 1010\ 1111\ 0111)_2$

011 = 3
000 = 0
101 = 5
011 = 3
110 = 6
111 = 7

$(18AF7)_{16} = (1)(16)^4 + 8(16)^3 + 10(16)^3 + (15)(16)^1 + (7)(16)^0$

$= 65536 + 32768 + 2560 + 240 + 7 = 101111$ ✗

⑧ Calcular para los números de 16 bits dados su representación en octal y hexadecimal:

C = 1100 0011 1111 0011
C 3 F 3 → $(C3F3)_{16}$

001 100 001 111 110 011
1 4 1 7 6 3 → $(141763)_8$

D = 1001 0000 0000 1010
9 0 0 A → $(900A)_{16}$

001 001 000 000 001 010
1 1 0 0 1 2 → $(110012)_8$

(9) Calcular la suma hexadecimal ABS + 9F2. Convertir datos y resultados en sus equivalentes decimales y comprobar que la suma es correcta.

$(ABS)_{16} = (10)(16)^2 + (11)(16)^1 + (5)(16)^0 = 2741$

$(9F2)_{16} = (9)(16)^2 + (15)(16)^1 + 2(16)^0 = 2546$

$$\begin{array}{r} 2741 \\ +\ 2546 \\ \hline 5287 \end{array} \qquad \begin{array}{r} ABS \\ +\ 9F2 \\ \hline 14A7 \end{array}$$

$= (14A7)_{16} = (5287)_{10}$

$$\begin{array}{r|l} 16 & 5287 \\ & 48 \\ & 07 \\ & 7 \end{array} \quad 0330$$

$$\begin{array}{r|l} 16 & 330 \\ & 10 \\ & 10 \\ & A \end{array} \quad 020$$

$$\begin{array}{r|l} 16 & 20 \\ & 4 \end{array} \quad 01 \qquad \begin{array}{r|l} 16 & 1 \\ & 1 \end{array} \quad 0$$

(10) Calcular el valor decimal de los números binarios (11100111) y (10111111) suponiendo que están representados en complemento a 2. Repetir el ejercicio suponiendo que están representados en complemento a 1.

$(11100111)_2\ C_2 = (00011001)_2 = 25$

$(10111111)_2\ C_2 = (01000001)_2 = 65$

$(11100111)_2\ C_1 = (00011000)_2 = (24)_{10}\ C_1$

$(10111111)_2\ C_1 = (01000000)_2 = (64)_{10}\ C_1$

PROBLEMAS ALGEBRA BOOLEANA

(1.) Demuestre las propiedades 2.2, 3.2', 3.3 y 3.4', mediante el metodo grafico ,tabular y algebraico

$$2.2 = X_1 + X_1 \cdot X_2 = X_1$$

Método gráfico

$X_1 \cdot X_2 \rightarrow X_1 \cap X_2$

$X_1 + X_1 \cdot X_2 \rightarrow X_1 \cup (X_1 \cap X_2)$

$X_1 =$

Método tabular

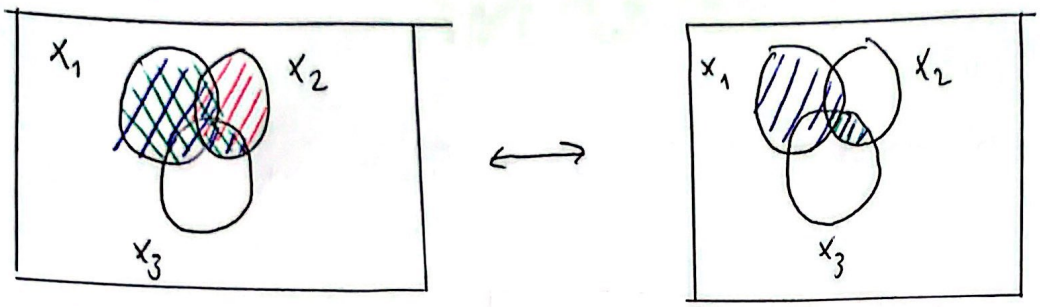
X_1	X_2	$X_1 \cdot X_2$	$X_1 + X_1 \cdot X_2$	X_1
0	0	0	0	0
0	1	0	0	0
1	0	0	1	1
1	1	1	1	1

Metodo Algebraico

$X_1 + X_1 \cdot X_2 = X_1 \longrightarrow X_1(1 \cdot X_2) = X_1(1) = X_1$

$$32 = (x_1 + x_2) \cdot (x_1 + x_3) = x_1 + x_2 \cdot x_3$$

Metodo grafico



$x_1 + x_2 \rightarrow x_1 \cup x_2$

$x_1 + x_3 \rightarrow x_1 \cup x_3$

$(x_1 + x_2) \cdot (x_1 + x_3) \rightarrow (x_1 \cup x_2) \cap (x_1 \cup x_3)$

$x_2 \cdot x_3 \rightarrow x_2 \cap x_3$

$x_1 + x_2 \cdot x_3 \rightarrow x_1 \cup (x_2 \cap x_3)$

Metodo tabular

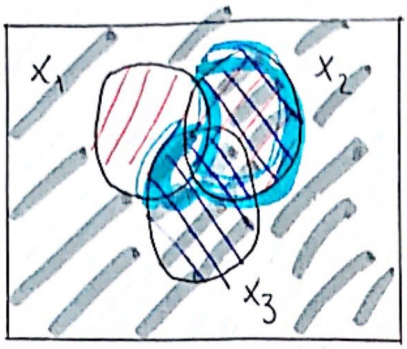
x_1	x_2	x_3	x_1+x_2	x_1+x_3	$x_2 \cdot x_3$	$x_1 + x_2 \cdot x_3$	$(x_1+x_2)\cdot(x_1+x_3)$
0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0
0	1	0	1	0	0	0	0
0	1	1	1	1	1	1	1
1	0	0	1	1	0	1	1
1	0	1	1	1	0	1	1
1	1	0	1	1	0	1	1
1	1	1	1	1	1	1	1

$=$

Metodo Algebraico

$$(x_1 + x_2) \cdot (x_1 + x_3) = x_1 x_1 + x_1 x_3 + x_2 x_1 + x_2 x_3 = x_1(1) + x_2 x_3$$
$$= x_1 + x_1 x_3 + x_2 x_1 + x_2 x_3$$
$$= x_1(1 + x_3) + x_2 x_1 + x_2 x_3 = x_1 + x_2 \cdot x_3$$
$$= x_1(1) + x_2 x_1 + x_2 x_3$$
$$= x_1 + x_2 x_1 + x_2 x_3$$
$$= x_1(1 + x_2) + x_2 x_3$$

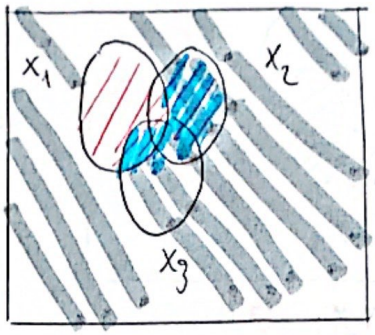
$$33 = (X_1 + X_2) \cdot (X_2 + X_3) \cdot (X_3 + X_1') = (X_1 + X_2) \cdot (X_3 + X_1')$$



$X_1 + X_2 \rightarrow X_1 \cup X_2$

$X_2 + X_3 \rightarrow X_2 \cup X_3$

$X_3 + X_1 \rightarrow X_3 \cup (\sim X_1)$



$X_1 + X_2 = X_1 \cup X_2$

$X_3 + X_1' = X_3 \cup \sim X_3$

$(X_1 + X_2) \cdot (X_2 + X_3) \cdot (X_3 + X_1')$

$= (X_1 + X_2) \cdot (X_3 + X_1')$

Metode tabular

X_1	X_2	X_3	X_1'	$X_1 + X_2$	$X_2 + X_3$	$X_3 + X_1'$	$(X_1+X_2)\cdot(X_2+X_3)\cdot(X_3+X_1')$	$(X_1+X_2)\cdot(X_3+X_1')$
0	0	0	1	0	0	1	0	0
0	0	1	1	0	1	1	0	0
0	1	0	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1
1	0	0	0	1	0	1	0	0
1	0	1	0	1	1	1	1	1
1	1	0	0	1	1	0	0	0
1	1	1	0	1	1	1	1	1

$=$ $=$

Metode algebraica

$(X_1+X_2) \cdot (X_2+X_3) \cdot (X_3+X_1')$

$f(X_1,X_2,X_3) = [X_1 + f(0,X_2,X_3)] \cdot [X_1' + f(1,X_2,X_3)]$

$f(0,X_2,X_3) = [0+X_2](X_2+X_3)(X_3+0') = (X_2)(X_2+X_3)(X_3+1) = (X_2)(X_2+X_3)(1)$

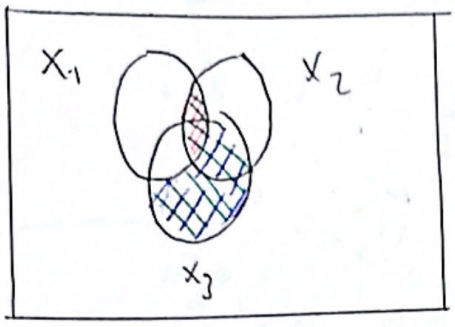
$= X_2 + X_2X_3 = X_2(1+X_3) = X_2(1) = X_2$

$f(1,X_2,X_3) = (1+X_2)(X_2+X_3)(X_3+(1)') = (1)(X_2+X_3)(X_3+0) = (X_2+X_3)(X_3)$

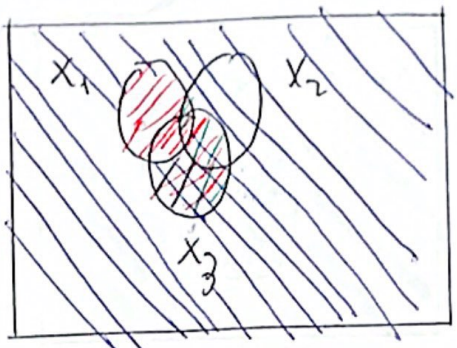
$= X_2X_3 + X_3 = X_3(X_2+1) = X_3(1) = X_3$

$f(X_1,X_2,X_3) = (X_1+X_2) \cdot (X_1'+X_3) = (X_1+X_2) \cdot (X_3+X_1')$

$3.4' = (x_1 \cdot x_2) + (x_1' x_3) = (x_1 + x_3) \cdot (x_1' + x_1)$



$\longleftrightarrow$



$x_1 \cap x_2$

$x_1' \cap x_3$

$(x_1 \cap x_2) \cup (x_1' \cap x_3)$

$x_1 + x_3 \rightarrow x_1 \cup x_3$

$x_1' \cup x_2 \rightarrow$

$(x_1 + x_3) \cap (x_1' + x_2)$

Metode tabular

x_1	x_2	x_3	x_1'	$x_1 \cdot x_2$	$x_1' x_3$	$(x_1 \cdot x_2) + (x_1' x_3)$	$x_1 + x_3$	$x_1' + x_2$	$(x_1 + x_3)(x_1' + x_2)$
0	0	0	1	0	0	0	0	1	0
0	0	1	1	0	1	1	1	1	1
0	1	0	1	0	0	0	0	1	0
0	1	1	1	0	1	1	1	1	1
1	0	0	0	0	0	0	1	0	0
1	0	1	0	0	0	0	1	0	0
1	1	0	0	0	0	0	1	1	1
1	1	1	0	1	0	1	1	1	1

$=$

Metode algebraice

$(x_1 \cdot x_2) + (x_1' \cdot x_3)$

$f(x_1, x_2, x_3) = [x_1 + f(0, x_2, x_3)] \cdot [x_1' + f(1, x_2, x_3)]$

$f(0, x_2, x_3) = (0 \cdot x_2) + ((0)' \cdot x_3) = 0 + (1 \cdot x_3) = x_3$

$f(1, x_2, x_3) = (1 \cdot x_2) + ((1)' \cdot x_3) = x_2 + (0 \cdot x_3) = x_2$

$f(x_1, x_2, x_3) = (x_1 + x_3) \cdot (x_1' + x_2)$

2. Dada la funcion $F(X_1, X_2, X_3) = (X_1 \cdot X_2 + X_3) \cdot (X_2 + X_3)$

Obtenga mediante el teorema de Demorgan la funcion

$F'(X_1, X_2, X_3)$

$$F'(X_1, X_2, X_3) = (X_1 \cdot X_2 + X_3)' + (X_2 + X_3)' = (X_1' + X_2' X_3) + X_2' X_3'$$

$$= X_1' + X_2' X_3 + X_2' X_3'$$

3. Dada la Funcion anterior realice una expansion en la variable X_3 para dicha funcion $F(X_1, X_2, X_3)$ mediante el teorema de expansion

$$X_3 \cdot F(X_1, X_2, 1) + X_3' \cdot F(X_1, X_2, 0)$$

$$F(X_1, X_2, 1) = (X_1 X_2 + 0) \cdot (X_2 + 1) = X_1 X_2 \cdot 1 = X_1 X_2$$

$$F(X_1, X_2, 0) = (X_1 X_2 + 1) \cdot (X_2 + 0) = 1 \cdot X_2 = X_2$$

$$= X_1 X_2 X_3 + X_2 X_3'$$