

Guía de laboratorio 2

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1) Convierta los siguientes números base 8 en base 10

$$a) (15364)_8 = (6900)_{10}$$

$$\begin{array}{cccccc} 1 & 5 & 3 & 6 & 4 & \\ 4 & 3 & 2 & 1 & 0 & \end{array} \quad 1 \cdot 8^4 + 5 \cdot 8^3 + 3 \cdot 8^2 + 6 \cdot 8^1 + 4 \cdot 8^0 \Rightarrow \boxed{6900}_{10}$$

$$b) (3721)_8 = (2001)_{10}$$

$$= (3) \cdot 8^3 + (7) \cdot 8^2 + (2) \cdot 8^1 + (1) \cdot 8^0 \Rightarrow \boxed{2001}_{10}$$

$$c) (3744)_8 = (2020)_{10}$$

$$= (3) \cdot 8^3 + (7) \cdot 8^2 + (4) \cdot 8^1 + (4) \cdot 8^0 \Rightarrow \boxed{2020}_{10}$$

$$d) (151)_8 = (105)_{10}$$

$$= (1) \cdot 8^2 + (5) \cdot 8^1 + (1) \cdot 8^0 \Rightarrow \boxed{105}_{10}$$

$$e) (1510)_8 = (840)_{10}$$

$$= (1) \cdot 8^3 + (5) \cdot 8^2 + (1) \cdot 8^1 + 0(8^0) = \boxed{840}_{10}$$

2) Convierta los siguientes números base 2 (Binario) en Base 10 (decimal)

$$a) (1001001)_2 = (73)_{10}$$

6 5 4 3 2 1 0

$$= 2^6 + 2^3 + 2^0 = 73$$

$$b) (10100)_2 = (20)_{10}$$

4 3 2 1 0

$$= 2^4 + 2^2 = 20$$

$$c) (1100101)_2 = (101)_{10}$$

6 5 4 3 2 1 0

$$= 2^6 + 2^5 + 2^2 + 2^0 = 101$$

$$d) (100110)_2 = (38)_{10}$$

5 4 3 2 1 0

$$= 2^5 + 2^2 + 2^1 = 38$$

$$e) (1010)_2 = (10)_{10}$$

3 2 1 0

$$= 2^3 + 2^1 = 10$$

3) Convierta los siguientes números Base 16 (Hexadecimal) en base 10 (decimal)

$$a) (24)_{16} = (36)_{10}$$

$$= (2 \cdot 16^1) + (4 \cdot 16^0) = 36$$

$$b) (86)_{16} = (134)_{10}$$

$$= (8 \cdot 16^1) + (6 \cdot 16^0) = 134$$

$$c) (1F8)_{16} = (504)_{10}$$

$$= (1 \cdot 16^2) + (15 \cdot 16^1) + (8 \cdot 16^0) = 504$$

$$d) (1CF)_{16} = (463)_{10}$$

$$= (1 \cdot 16^2) + (12 \cdot 16^1) + (15 \cdot 16^0) = 463$$

$$e) (17E)_{16} = (382)_{10}$$

$$= (1 \cdot 16^2) + (7 \cdot 16^1) + (14 \cdot 16^0) = 382$$

$$10 = A$$

$$11 = B$$

$$12 = C$$

$$13 = D$$

$$14 = E$$

$$15 = F$$

5) Efectuar las siguientes sumas, tal como se realizan en el ALU

a) $(35)_{10} + (75)_{10}$ con 9 bits

$$\begin{array}{r} 17 \\ 2 \overline{) 35} \\ \underline{2} \\ 15 \\ \underline{14} \\ 1 \end{array} \quad \begin{array}{r} 8 \\ 2 \overline{) 17} \\ \underline{16} \\ 1 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 8} \\ \underline{8} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 \times 11 = \boxed{000100011} \quad MV$$

$$\begin{array}{r} 37 \\ 2 \overline{) 75} \\ \underline{6} \\ 15 \\ \underline{14} \\ 1 \end{array} \quad \begin{array}{r} 18 \\ 2 \overline{) 37} \\ \underline{36} \\ 1 \end{array} \quad \begin{array}{r} 9 \\ 2 \overline{) 18} \\ \underline{18} \\ 0 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 9} \\ \underline{8} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 \times 1 = \boxed{001001011}$$

$$\begin{array}{r} 000100011 \\ + 001001011 \\ \hline 001101100 \end{array} = \boxed{001101100} \quad C_2$$

b) $(-35)_{10} + (-75)_{10}$ con 9 bits

$$\begin{array}{r} 17 \\ 2 \overline{) 35} \\ \underline{2} \\ 15 \\ \underline{14} \\ 1 \end{array} \quad \begin{array}{r} 8 \\ 2 \overline{) 17} \\ \underline{16} \\ 1 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 8} \\ \underline{8} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 \times 11 = \boxed{100100011} \quad MV$$

$$= 111011100 \quad C_1$$

$$-35 = \boxed{1111011101} \quad C_2$$

$$\begin{array}{r} 37 \\ 2 \overline{) 75} \\ \underline{74} \\ 1 \end{array} \quad \begin{array}{r} 18 \\ 2 \overline{) 37} \\ \underline{36} \\ 1 \end{array} \quad \begin{array}{r} 9 \\ 2 \overline{) 18} \\ \underline{18} \\ 0 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 9} \\ \underline{8} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 \times 11 = \boxed{101001011} \quad MV$$

$$= 110110100 \quad C_1$$

$$= \boxed{11101110101} \quad C_2$$

$$= 1111011101$$

$$+ 110110101$$

$$\begin{array}{r} 101101101 \\ 101101110 \end{array}$$

$$= \boxed{11100110010} \quad C_2$$

c) $(84)_{10} + (-92)_{10}$ con 11 bits

$$\begin{array}{r} 42 \\ 2 \overline{) 84} \\ \underline{84} \\ 0 \end{array} \quad \begin{array}{r} 21 \\ 2 \overline{) 42} \\ \underline{42} \\ 0 \end{array} \quad \begin{array}{r} 10 \\ 2 \overline{) 21} \\ \underline{20} \\ 1 \end{array} \quad \begin{array}{r} 5 \\ 2 \overline{) 10} \\ \underline{10} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 1010100$$

$$\begin{array}{r} 46 \\ 2 \overline{) 92} \\ \underline{92} \\ 0 \end{array} \quad \begin{array}{r} 23 \\ 2 \overline{) 46} \\ \underline{46} \\ 0 \end{array} \quad \begin{array}{r} 11 \\ 2 \overline{) 23} \\ \underline{22} \\ 1 \end{array} \quad \begin{array}{r} 5 \\ 2 \overline{) 11} \\ \underline{10} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 1010100$$

$$84 = \boxed{00001010100}$$

$$-92 = \boxed{110001011100} \text{ MV}$$

$$= +11110100011 \text{ C}_1$$

$$\boxed{111110100100} \text{ C}_2$$

$$\begin{array}{r} 00001010100 \\ + 11110100100 \\ \hline 11111111000 \end{array}$$

$$= \boxed{11111111000} \text{ C}_2$$

d) $(-61)_{10} + (79)_{10}$ con 9 bits

$$\begin{array}{r} 30 \\ 2 \overline{) 61} \\ \underline{60} \\ 1 \end{array} \quad \begin{array}{r} 15 \\ 2 \overline{) 30} \\ \underline{30} \\ 0 \end{array} \quad \begin{array}{r} 7 \\ 2 \overline{) 15} \\ \underline{14} \\ 1 \end{array} \quad \begin{array}{r} 3 \\ 2 \overline{) 7} \\ \underline{6} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 3} \\ \underline{2} \\ 1 \end{array} \quad 2 > 1 = 111101$$

$$= \boxed{100111101} \text{ MV}$$

$$= 111000010 \text{ C}_1$$

$$= \boxed{1111000011} \text{ C}_2$$

$$\begin{array}{r} 39 \\ 2 \overline{) 79} \\ \underline{78} \\ 1 \end{array} \quad \begin{array}{r} 19 \\ 2 \overline{) 39} \\ \underline{38} \\ 1 \end{array} \quad \begin{array}{r} 9 \\ 2 \overline{) 19} \\ \underline{18} \\ 1 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 9} \\ \underline{8} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 1001111$$

$$= \boxed{001001111}$$

$$= 111000011$$

$$+ 001001111$$

$$000010010$$

$$= \boxed{000010010}$$

e) $(20)_{10} + (-68)_{10}$ con 9 bits

$$\begin{array}{r} 10 \\ 2 \overline{) 20} \\ \underline{20} \\ 0 \end{array} \quad \begin{array}{r} 5 \\ 2 \overline{) 10} \\ \underline{10} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 10100$$

$$= 000010100$$

$$\begin{array}{r} 34 \\ 2 \overline{) 68} \\ \underline{68} \\ 0 \end{array} \quad \begin{array}{r} 17 \\ 2 \overline{) 34} \\ \underline{34} \\ 0 \end{array} \quad \begin{array}{r} 8 \\ 2 \overline{) 17} \\ \underline{16} \\ 1 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 8} \\ \underline{8} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 101000100$$

$$M_v$$

$$= 110111011 \quad C_1$$

$$+ 1110111100 \quad C_2$$

$$\begin{array}{r} 111 \\ 000010100 \\ + 110111000 \\ \hline 100101100 \\ 1100000 \end{array}$$

$$= \boxed{1110100000} \quad C_2$$

f) $(-23)_{10} + (-10)_{10}$ con 8 bits

$$\begin{array}{r} 11 \\ 2 \overline{) 23} \\ \underline{22} \\ 1 \end{array} \quad \begin{array}{r} 5 \\ 2 \overline{) 11} \\ \underline{10} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 10111$$

$$= 110010111 \quad M_v$$

$$= 111010000 \quad C_1$$

$$= 111101001 \quad C_2$$

$$\begin{array}{r} 9 \\ 2 \overline{) 10} \\ \underline{10} \\ 0 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 5} \\ \underline{4} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 = 1010$$

$$= 110001010 \quad M_v$$

$$= 11110101 \quad C_1$$

$$= 111110110 \quad C_2$$

$$\begin{array}{r} 111101001 \\ + 11110110 \\ \hline 111011111 \end{array}$$

$$= \boxed{111011111} \quad C_2$$

g) $(-93)_{10} + (83)_{10}$ con 11 bits

$$\begin{array}{r}
 \begin{array}{r}
 \overset{4}{4} \cdot \overset{2}{2} \\
 2 \overline{) 93} \\
 \underline{86} \\
 7 \\
 \underline{6} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{3}{3} \\
 2 \overline{) 46} \\
 \underline{46} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \cdot \overset{1}{1} \\
 2 \overline{) 23} \\
 \underline{22} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{5}{5} \\
 2 \overline{) 11} \\
 \underline{10} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{2}{2} \\
 2 \overline{) 5} \\
 \underline{4} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \\
 2 \overline{) 2} \\
 \underline{2} \\
 0
 \end{array}
 \quad
 2 > 1 = 1011101
 \end{array}$$

$$= \boxed{1100010111101} \text{ Mv}$$

$$= \boxed{11110100010} \text{ C}_1$$

$$= \boxed{11110100011} \text{ C}_2$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{4}{4} \cdot \overset{1}{1} \\
 2 \overline{) 83} \\
 \underline{82} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{0}{0} \\
 2 \overline{) 41} \\
 \underline{40} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{10}{10} \\
 2 \overline{) 20} \\
 \underline{20} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{5}{5} \\
 2 \overline{) 10} \\
 \underline{10} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{2}{2} \\
 2 \overline{) 5} \\
 \underline{4} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \\
 2 \overline{) 2} \\
 \underline{2} \\
 0
 \end{array}
 \quad
 2 > 1 = 1010011
 \end{array}$$

$$= \boxed{00001010011}$$

$$\begin{array}{r}
 11110100011 \\
 + 00001010011 \\
 \hline
 11111110110
 \end{array}
 = \boxed{11111110110} \text{ C}_2$$

h) $(-39)_{10} + (48)_{10}$ con 8 bits

$$\begin{array}{r}
 \begin{array}{r}
 \overset{1}{1} \cdot \overset{4}{4} \\
 2 \overline{) 39} \\
 \underline{38} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{4}{4} \\
 2 \overline{) 19} \\
 \underline{18} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{4}{4} \\
 2 \overline{) 9} \\
 \underline{8} \\
 1
 \end{array}
 \quad
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{2}{2} \\
 2 \overline{) 4} \\
 \underline{4} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \\
 2 \overline{) 2} \\
 \underline{2} \\
 0
 \end{array}
 \quad
 2 > 1 = 100111
 \end{array}$$

$$= \boxed{10100111} \text{ Mv}$$

$$= \boxed{11011000} \text{ C}_1$$

$$= \boxed{11011001} \text{ C}_2$$

$$\begin{array}{r}
 \begin{array}{r}
 \overset{2}{2} \cdot \overset{4}{4} \\
 2 \overline{) 48} \\
 \underline{48} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \cdot \overset{2}{2} \\
 2 \overline{) 24} \\
 \underline{24} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{6}{6} \\
 2 \overline{) 12} \\
 \underline{12} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{3}{3} \\
 2 \overline{) 6} \\
 \underline{6} \\
 0
 \end{array}
 \quad
 \begin{array}{r}
 \overset{1}{1} \\
 2 \overline{) 3} \\
 \underline{2} \\
 1
 \end{array}
 \quad
 2 > 1 = 110000
 \end{array}$$

$$= \boxed{00110000}$$

$$\begin{array}{r}
 110000 \\
 + 11011001 \\
 \hline
 00011001
 \end{array}
 = \boxed{00011001}$$

i) $(75)_{10} + (-56)_{10}$ con 9 bits

$$\begin{array}{r} 37 \\ 2 \overline{) 75} \\ \underline{74} \\ 1 \end{array} \quad \begin{array}{r} 18 \\ 2 \overline{) 37} \\ \underline{36} \\ 1 \end{array} \quad \begin{array}{r} 9 \\ 2 \overline{) 18} \\ \underline{18} \\ 0 \end{array} \quad \begin{array}{r} 4 \\ 2 \overline{) 9} \\ \underline{8} \\ 1 \end{array} \quad \begin{array}{r} 2 \\ 2 \overline{) 4} \\ \underline{4} \\ 0 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 2} \\ \underline{2} \\ 0 \end{array} \quad 2 > 1 \Rightarrow 1001011$$

$$= 001001011$$

$$\begin{array}{r} 28 \\ 2 \overline{) 56} \\ \underline{56} \\ 0 \end{array} \quad \begin{array}{r} 14 \\ 2 \overline{) 28} \\ \underline{28} \\ 0 \end{array} \quad \begin{array}{r} 7 \\ 2 \overline{) 14} \\ \underline{14} \\ 0 \end{array} \quad \begin{array}{r} 3 \\ 2 \overline{) 7} \\ \underline{6} \\ 1 \end{array} \quad \begin{array}{r} 1 \\ 2 \overline{) 3} \\ \underline{2} \\ 1 \end{array} \quad 2 > 1 \Rightarrow 111000$$

$$= 100111000 \quad M_v$$

$$= 111000111 \quad C_1$$

$$+ 1111001000 \quad C_2$$

$$\begin{array}{r} 1001001011 \\ + 1110010000 \\ \hline 000010011 \end{array} = 000010011$$

j) $(-75)_{10} + (56)_{10}$ con 9 bits

$$-(75)_{10} = 1001011 = 1101001011 \quad M_v$$

$$= 110110100 \quad C_1$$

$$= 1110110101 \quad C_2$$

$$(56)_{10} = 111000 = 000111000$$

$$\begin{array}{r} 110110101 \\ + 000111000 \\ \hline 111101101 \end{array} = 111101101 \quad C_2$$

K) $(-120)_{10} + (-88)_{10}$ con 11 bits

$$\begin{array}{r}
 \begin{array}{l}
 60 \\
 2 \overline{) 120} \\
 \underline{120} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 30 \\
 2 \overline{) 60} \\
 \underline{60} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 15 \\
 2 \overline{) 30} \\
 \underline{30} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 7 \\
 2 \overline{) 15} \\
 \underline{14} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 3 \\
 2 \overline{) 7} \\
 \underline{6} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 1 \\
 2 \overline{) 3} \\
 \underline{2} \\
 1
 \end{array}
 \quad
 2 > 1 = 1111000
 \end{array}$$

$$\begin{array}{l}
 = 10001111000 \text{ Mv} \\
 = 111100000111101 \text{ C}_1 \\
 + \\
 \rightarrow 111110000100001 \text{ C}_2
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{l}
 44 \\
 2 \overline{) 88} \\
 \underline{88} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 22 \\
 2 \overline{) 44} \\
 \underline{44} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 11 \\
 2 \overline{) 22} \\
 \underline{22} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 5 \\
 2 \overline{) 11} \\
 \underline{10} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 2 \\
 2 \overline{) 5} \\
 \underline{4} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 1 \\
 2 \overline{) 2} \\
 \underline{2} \\
 0
 \end{array}
 \quad
 2 > 1 = 1011000
 \end{array}$$

$$\begin{array}{l}
 = 100010111000 \text{ Mv} \\
 = 111101000111101 \text{ C}_1 \\
 + \\
 \rightarrow 111110110100001 \text{ C}_2
 \end{array}$$

$$\begin{array}{r}
 1111100010000 \\
 + 1111101100000 \\
 \hline
 1111001100088
 \end{array}$$

$$= \boxed{1111001100000} \text{ C}_2$$

1) $(-105)_{10} + (105)_{10}$ con 10 bits

$$\begin{array}{r}
 \begin{array}{l}
 52 \\
 2 \overline{) 105} \\
 \underline{104} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 26 \\
 2 \overline{) 52} \\
 \underline{52} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 13 \\
 2 \overline{) 26} \\
 \underline{26} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 6 \\
 2 \overline{) 13} \\
 \underline{12} \\
 1
 \end{array}
 \quad
 \begin{array}{l}
 3 \\
 2 \overline{) 6} \\
 \underline{6} \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 1 \\
 2 \overline{) 3} \\
 \underline{2} \\
 1
 \end{array}
 \quad
 2 > 1 = 1101001
 \end{array}$$

$$\begin{array}{l}
 \text{Mv} = 1001101001 \\
 \text{C}_1 = 1110010110 \\
 \text{C}_2 = 111100110111
 \end{array}$$

$$\begin{array}{r}
 (105)_{10} = 0001101001 \\
 (-105)_{10} = + 1110010111 \\
 \hline
 0000000000
 \end{array}$$

$$= \boxed{0000000000}$$