



Sistemas de Procesamiento de Datos

TP: Sistemas numéricos – Cambio de
base – Reales son signo

Ejercicios resueltos



TP: Sistemas numéricos – Cambio de base – Reales con signo

①

1) Expresar en Ca2, mínima cant. de bits

a) $+31,6015625_d = 011111,1001101_b$

$+31 = 011111_b$

$0,6015625 \times 2 = 1,203125$

$0,203125 \times 2 = 0,40625$

$0,40625 \times 2 = 0,8125$

$0,8125 \times 2 = 1,625$

$0,625 \times 2 = 1,25$

$0,25 \times 2 = 0,5$

$0,5 \times 2 = 1,0$

b) $-610,94140625_d = 10110011101,00001111_b$

$+610 = 01001100010_b$

$0,94140625 \times 2 = 1,8828125$

$0,8828125 \times 2 = 1,765625$

$0,765625 \times 2 = 1,53125$

$0,53125 \times 2 = 1,0625$

$0,0625 \times 2 = 0,125$

$0,125 \times 2 = 0,25$

$0,25 \times 2 = 0,5$

$0,5 \times 2 = 1,0$

$+610,94140625 =$

$= 01001100010,11110001_b$

$= 10110011101,00001110_b$

$+ \quad \quad \quad 1_b$

$10110011101,00001111_b$



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2) Idem, 1 byte \rightarrow 6,2, solo (T)

$$a) +27,7_d = \underline{011011}, \underline{10}_b$$

$$\bullet) +27_d = \underline{011011}_b$$

$$\bullet) 0,7_d \times 2 = \underline{1,4} \quad \bullet) 0,7_d = \underline{010}_b$$

$$0,4 \times 2 = \underline{0,8} \quad \bullet) 0,4 = \underline{01}_b$$

$$b) -19,04_d = \underline{101101}, \underline{00}_b$$

$$\bullet) +19_d = \underline{010011}_b$$

$$\bullet) 0,04_d = \underline{000}_b$$

$$0,04 \times 2 = \underline{0,08}$$

$$0,08 \times 2 = \underline{0,16}$$

$$+19,04_d = \underline{010011}, \underline{00}_b$$

Car

$$+ \underline{101100}, \underline{11}_b$$

$$+ \underline{1}_b$$

$$\underline{101101}, \underline{00}_b = -19,04_d$$

3) Idem, 1 byte, 6,2, (RT)

$$a) +29,4_d = \underline{011101}, \underline{10}_b$$

$$\bullet) +29_d = \underline{011101}_d$$

$$\bullet) 0,4 \times 2 = \underline{0,8} \quad \rightarrow 0,4_d = \underline{0,011}_b$$

$$0,8 \times 2 = \underline{1,6}$$

$$0,6 \times 2 = \underline{1,2}$$

$$+ \underline{0,100}_b$$

$$\underline{0,100}_b \rightarrow 0,4_d = \underline{0,10}_b$$



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b) $-19,39872_d = \underline{101100}, \underline{10}_b$

•) $+19_d = \underline{010011}_b$ ①

•) $+0,39872_d = 0, \dots$

$0,39872 \times 2 = 0,79744$

$0,79744 \times 2 = 1,59488$

$0,59488 \times 2 = 1,18976$

$0,39872_d = 0,0111$
 $+ \dots$
 $0,1010 \rightarrow = 0,10$ ②

Suma ① y ②

$+19,39872_d = \underline{010011}, \underline{10}_b$
 $\quad \quad \quad 101100, \underline{01}_b$ car
 $\quad \quad \quad + \quad \quad \quad 1_b$
 $\underline{101100}, \underline{10}_b = -19,39872_d$

4) Operaciones, Ca2, 12 bits (8,4), (RT)

a) $+71,3_d - 110,78_d = \underline{11011000}, \underline{1001}_b$

•) $+71,3_d = \underline{01000111}, \underline{0101}_b$ ① =

$+71_d = 1000111_b$

$+0,3_d =$

$0,3 \times 2 = 0,6$

$0,6 \times 2 = 1,2$

$0,2 \times 2 = 0,4$

$0,4 \times 2 = 0,8$

$0,8 \times 2 = 1,6$

$0,3_d = 0,01001_b$
 $+ \dots$
 $0,01010 \rightarrow 0,0101_b$



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(4)

• $-110,78_d = 10010001,0100_b \text{ (III)}$

$+110,78_d = 01101110,1100_b \text{ (II)}$

• $110_d = 1101110$

• $0,78_d =$

$0,78 \times 2 = 1,56$

$0,56 \times 2 = 1,12$

$0,12 \times 2 = 0,24$

$0,24 \times 2 = 0,48$

$0,48 \times 2 = 0,96$

$0,78 = 0,110010$

$0,110010 \rightarrow 0,1100$

Suma el Ca2 de (II)

$$\begin{array}{r} 01101110,1100_b \\ + 10010001,0011_b \\ \hline 10010001,0100_b = -110,78 \end{array}$$

Suma (I) y (III)

$$\begin{array}{r} 01000111,0101_b \geq +71,3125_d \\ + 10010001,0100_b = -110,75_d \\ \hline 11011000,1001_b = -39,4375_d \\ \text{Cal} \rightarrow \begin{array}{r} 00100111,0110_b \\ + 00100111,0110_b \\ \hline 00100111,0111_b = +39,4375_d \end{array} \end{array}$$

Verificación!

$\frac{1}{4} + \frac{1}{8} + \frac{1}{16} = \frac{4+2+1}{16} = \frac{7}{16} = 0,4375$



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b) $-96,712_d = \underline{10001001}, \underline{1100}_b$ (V)

• $-96,712_d \approx \underline{10011111}, \underline{0101}_b$ (II) $\rightarrow -96,6875_d$

$+96,712_d \approx \underline{01100000}, \underline{1011}_b$ (I) $\rightarrow +96,6875_d$

$96_d = 1100000_b$

$0,712_d =$

$0,712 \times 2 = 1,424$

$0,424 \times 2 = 0,848$

$0,848 \times 2 = 1,696$

$0,696 \times 2 = 1,392$

$0,392 \times 2 = 0,784$

$0,712_d = 0, \underline{1011}_b$

$\rightarrow 0,1011_b$

$\rightarrow 0,1011_b = \frac{1}{2} + \frac{1}{8} + \frac{1}{16} = \frac{8+2+1}{16} = \frac{11}{16} = 0,6875$

Cal (I)

$+96,712 \approx \underline{01100000}, \underline{1011}_b$
 $\underline{10011111}, \underline{0101}_b$ Cal
 $\rightarrow \underline{10011111}, \underline{0101}_b \approx -96,712_d$ (II)

• $-21,56_d = \underline{11101010}, \underline{0111}_b$ (IV)

$+21,56_d = \underline{00010101}, \underline{1001}_b$ (III) $\rightarrow +21,5625_d$

$21_d = 10101$



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$$0,56_d \approx 0,1001_b$$

$$0,56 \times 2 = 1,12$$

$$0,12 \times 2 = 0,24$$

$$0,24 \times 2 = 0,48$$

$$0,48 \times 2 = 0,96$$

$$0,96 \times 2 = 1,92$$

$$0,56_d \approx 0,10001_b$$

$$0,1001_b \rightarrow 0,56_d \approx 0,1001_b$$

ca2 de (III)

$$0,1001_b = \frac{1}{2} + \frac{1}{16} = \frac{9}{16} = 0,5625_d$$

$$\begin{array}{r} + 21,56_d \approx 00010101,1001_b \\ 11101010,0110_b \text{ Cal} \\ + \quad \quad \quad 1_b \\ \hline 11101010,0111_b \approx -21,56_d \text{ (IV)} \end{array}$$

Suma (II) + (IV)

$$\begin{array}{r} \text{①} \leftarrow \begin{array}{r} 11111111111111111111 \\ -96,76_d \approx 10011111,0101_b = -96,6875_d \\ + -21,56_d \approx 11101010,0111_b = -21,5625_d \end{array} \left. \begin{array}{l} \\ \end{array} \right\} \text{Verifica!} \\ \text{⑤} \quad 10001001,1100 \quad -118,2500_d \\ \text{Cal} \rightarrow \begin{array}{r} 01110110,0111_b \\ + \quad \quad \quad 1_b \\ \hline 01110110,0100_b = +118,25_d \end{array} \end{array}$$

64 32 16 8 4 1/4



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c) $+44,81_d + 8,63_d \approx \underline{00110101}, \underline{0111}_b = +53,4375_d$ ⑦

-) $+44,81_d \approx \underline{00101100}, \underline{1101}_b = +44,8125_d$ ①

• $44_d = 101100_b$

• $0,81_d =$

$0,81 \times 2 = 1,62$

$0,62 \times 2 = 1,24$

$0,24 \times 2 = 0,48$

$0,48 \times 2 = 0,96$

$0,96 \times 2 = 1,92$

$$\begin{array}{r} 0,81 = 0,11001 \\ + \\ \hline 0,11010 \end{array} \rightarrow 0,81 = 0,1101_b$$

$$0,1101_b = \frac{1}{2} + \frac{1}{4} + \frac{1}{16} = \frac{8+4+1}{16} = \frac{13}{16} = 0,8125_d$$

•) $+8,63_d \approx \underline{00001000}, \underline{1010}_b = +8,625_d$ ②

-) $8_d = 1000_b$

-) $0,63_d$

$0,63 \times 2 = 1,26$

$0,26 \times 2 = 0,52$

$0,52 \times 2 = 1,04$

$0,04 \times 2 = 0,08$

$0,08 \times 2 = 0,16$

$$\begin{array}{r} 0,63 = 0,10100 \\ + \\ \hline 0,10101 \end{array} \rightarrow 0,1010_b$$

$$0,1010_b = \frac{1}{2} + \frac{1}{8} = \frac{4+1}{8} = \frac{5}{8} = 0,625_d$$

Suma ① y ②

$$\begin{array}{r} 00101100,1101_b = +44,8125_d \\ + 00001000,1010_b = +8,625_d \\ \hline 00110101,0111_b = +53,4375_d \end{array} \left. \vphantom{\begin{array}{r} 00101100,1101_b \\ + 00001000,1010_b \end{array}} \right\} \text{Verifica!}$$

$\underline{32} \quad \underline{16} \quad \underline{4} \quad \underline{1}$

$$\frac{1}{4} + \frac{1}{8} + \frac{1}{16} = \frac{4+2+1}{16} = \frac{7}{16} = 0,4375$$



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d) $-101,812_d + 66,66_d = \underline{11\ 01\ 11\ 00}, \underline{11\ 10}_6 = -33,125_d$ (IV) (8)

•) $-101,812_d \approx \underline{100\ 110\ 10}, \underline{00\ 11}_6$ (II) $= -101,8125_d$

$+101,812_d \approx \underline{01\ 100\ 101}, \underline{11\ 01}_6$ (E)

$101_d = 1100101$

$\rightarrow 0,812_d \times 2 = 1,624_d$
 $0,624_d \times 2 = 1,248_d$
 $0,248_d \times 2 = 0,496_d$
 $0,496_d \times 2 = 0,992_d$
 $0,992_d \times 2 = 1,984_d$

$0,812_d \approx 0, \underline{1\ 100\ 1}_6$
 $+ \quad \quad \quad 1$
 $\hline 0, \underline{1\ 101}_6 \Rightarrow$

$0,812_d \approx 0,1101_6 = \frac{1}{2} + \frac{1}{4} + \frac{1}{16} = \frac{13}{16} = 0,8125_d$

Cal (I)

$\underline{01\ 100\ 101}, \underline{11\ 01}_6$
 $\underline{100\ 110\ 10}, \underline{00\ 10}_6$ Cal
 $+ \quad \quad \quad 1$

$\underline{100\ 110\ 10}, \underline{00\ 11}_6 = -101,8125 \approx -101,812_d$ (II) ↑

•) $+66,66_d \approx \underline{01\ 000\ 010}, \underline{10\ 11}_6 = +66,6875_d$ (III)

$\rightarrow 66_d = 1000010$

$\rightarrow 0,66_d \times 2 = 1,32_d$
 $0,32_d \times 2 = 0,64_d$
 $0,64_d \times 2 = 1,28_d$
 $0,28_d \times 2 = 0,56_d$
 $0,56_d \times 2 = 1,12_d$

$0,66_d \approx 0, \underline{10\ 10\ 1}_6$
 $+ \quad \quad \quad 1$
 $\hline 0, \underline{10\ 11}_6$

$0,1011_6 = \frac{1}{2} + \frac{1}{8} + \frac{1}{16} = \frac{8+2+1}{16} = \frac{11}{16} = 0,6875_d$



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⑨

Suma ② y ③

$$\begin{array}{r} 10011010,0011_b = -101,8125_d \\ + 01000010,1011_b = +66,6875_d \\ \hline 11011100,1110_b = -35,125_d \end{array} \quad \text{Verifica!}$$

Cal

$$\begin{array}{r} 00100011,0001_b \\ + 15 \\ \hline 00100011,0010_b = +35,125_d \end{array}$$

32 21

