

Carlos Luiz Almeida Santos

## Lista de exercícios

1) Realize as conversões entre as bases numéricas.

a)  $(1001)_2 = (9)_{10}$

$$(1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0)$$
$$8 + 0 + 0 + 1$$
$$\therefore (9)_{10}$$

b)  $(110,01)_2 = (6,25)_{10}$

$$(1 \times 2^2) + (1 \times 2^1) + (0 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2})$$
$$4 + 2 + 0 + 0 + 0,25$$
$$\therefore (6,25)_{10}$$

c)  $(1010)_{16} = (4.112)_{10}$

$$(1 \times 16^3) + (0 \times 16^2) + (1 \times 16^1) + (0 \times 16^0)$$
$$4.096 + 0 + 16 + 0$$
$$\therefore (4.112)_{10}$$

d)  $(100100)_{10} = (18704)_{16}$

$$100100 \mid 16$$

4

$$6.256 \mid 16$$

$$\therefore (18704)_{16}$$

0

$$391 \mid 16$$

7

$$24 \mid 16$$

8

1

2) Calcule as operações aritméticas no sistema binário utilizando complemento de 2.

a)  $(10)_{10} + (9)_{10} = (10011)_2$

$$10 \mid 2$$

$$\begin{array}{r} 0 \ 5 \ 1 \ 2 \\ 1 \ 0 \ 1 \ 0 \\ \hline 0 \ 1 \end{array}$$

$$\rightarrow (1010)_2$$

$$9 \mid 2$$

$$\begin{array}{r} 1 \ 4 \ 1 \ 2 \\ 1 \ 0 \ 1 \ 0 \\ \hline 0 \ 1 \end{array}$$

$$\rightarrow (1001)_2$$

$$1010$$

$$+ 1001$$

$$10011$$

$$b) (150)_{10} - (48)_{10} = (01100110)_2$$

$$150 | 2$$

$$0 \quad 75 | 2$$

$$1 \quad 37 | 2$$

$$1 \quad 18 | 2$$

$$0 \quad 9 | 2$$

$$1 \quad 4 | 2$$

$$48 | 2$$

$$0 \quad 24 | 2$$

$$0 \quad 12 | 2$$

$$0 \quad 6 | 2$$

$$0 \quad 3 | 2$$

$$1$$

$$(150)_{10} = (10010110)_2$$

$$(48)_{10} = (110000)_2$$

→ Complemento de 2

$$(48)_{10} = (010000)_2$$

$$(-48)_{10} = (1010000)_2$$

$$\begin{array}{r} 10010110 \\ + 11010000 \\ \hline 01100110 \end{array}$$

$$e) (255)_{10} - (127)_{10} = (10000000)_2$$

$$255 | 2$$

$$1 \quad 127 | 2$$

$$1 \quad 63 | 2$$

$$1 \quad 31 | 2$$

$$15 | 2$$

$$7 | 2$$

$$127 | 2$$

$$1 \quad 63 | 2$$

$$1 \quad 31 | 2$$

$$15 | 2$$

$$7 | 2$$

$$3 | 2$$

$$1$$

$$(255)_{10} = (11111111)_2$$

$$(127)_{10} = (1111111)_2$$

→ Complemento de 2

$$(127)_{10} = (0000001)_2$$

$$(-127)_{10} = (10000001)_2$$

$$\begin{array}{r} 11111111 \\ + 10000001 \\ \hline 11000000 \end{array}$$

$$\text{Carry} \rightarrow 110000000$$



$$d) (12)_{10} - (25)_{10} = (110011)_2$$

$$12 \mid 2$$

$$0 \quad 6 \mid 2$$

$$0 \quad 3 \mid 2$$

$$25 \mid 2$$

$$1 \quad 12 \mid 2$$

$$0 \quad 6 \mid 2$$

$$0 \quad 3 \mid 2$$

$$(12)_{10} = (1100)_2$$

$$(25)_{10} = (11001)_2$$

→ Complemento de 2

$$(25)_{10} = (00111)_2$$

$$(-25)_{10} = (100111)_2$$

$$001100$$

$$+ 100111$$

$$110011$$

$$e) (1505)_{10} - (2012)_{10} = (111000000101)_2$$

$$1505 \mid 2$$

$$1 \quad 752 \mid 2$$

$$0 \quad 376 \mid 2$$

$$2012 \mid 2$$

$$0 \quad 1006 \mid 2$$

$$0 \quad 503 \mid 2$$

$$1 \quad 251 \mid 2$$

$$1 \quad 125 \mid 2$$

$$1 \quad 62 \mid 2$$

$$(1505)_{10} = (10111100001)_2$$

$$(2012)_{10} = (11111011100)_2$$

→ Complemento de 2

$$(2012)_{10} = (00000100100)_2$$

$$(-2012)_{10} = (100000100100)_2$$

$$010111100001$$

$$+ 100000100100$$

$$111000000101$$

$$0 \quad 31 \mid 2$$

$$1 \quad 15 \mid 2$$

$$1 \quad 7 \mid 2$$

$$1 \quad 3 \mid 2$$

$$1 \quad 1 \mid 2$$

$$1 \quad 5 \mid 2$$

$$1 \quad 2 \mid 2$$

$$0 \quad 1$$

$$f) (147)_{10} - (147)_{10} = (0000000000)_2$$

$$147 \div 2$$

$$73 \div 2$$

$$36 \div 2$$

$$18 \div 2$$

$$9 \div 2$$

$$4 \div 2$$

$$2 \div 2$$

$$1 \div 2$$

$$(147)_{10} = (10010011)_2$$

→ Complemento de 2

$$(147)_{10} = (01101101)_2$$

$$(-147)_{10} = (101101101)_2$$

$$010010011$$

$$+ 101101101$$

$$000000000$$

$$g) (101)_{10} \times (13)_{10} = (10100100001)_2$$

$$101 \div 2$$

$$50 \div 2$$

$$25 \div 2$$

$$12 \div 2$$

$$6 \div 2$$

$$3 \div 2$$

$$1 \div 2$$

$$13 \div 2$$

$$6 \div 2$$

$$3 \div 2$$

$$1 \div 2$$

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

$$(13)_{10} = (1101)_2$$

$$1100101$$

$$\times 1101$$

$$1100101$$

$$0000000$$

$$1100101$$

$$+ 1100101$$

$$10100100001$$



$$k) (222)_{10} / (41)_{10} =$$

$$222 \mid 2$$

$$0 \quad 111 \mid 2$$

$$1 \quad 55 \mid 2$$

$$1 \quad 27 \mid 2$$

$$1 \quad 13 \mid 2$$

$$1 \quad 6 \mid 2$$

$$0 \quad 3 \mid 2$$

$$1 \quad 1$$

$$41 \mid 2$$

$$1 \quad 20 \mid 2$$

$$0 \quad 10 \mid 2$$

$$0 \quad 5 \mid 2$$

$$1 \quad 2 \mid 2$$

$$0 \quad 1$$

$$(222)_{10} = (11011110)_2$$

$$(41)_{10} = (101001)_2$$

$$\begin{array}{r} 11011110 \mid 101001 \\ - 101001 \phantom{000000} \\ \hline 00111010 \\ - 101001 \\ \hline 010001 \end{array}$$

3) Expressar segundo a norma IEEE 754 de precisão simples os seguintes números

a)  $72 = 0 \quad 10000101 \quad 001000000000000000000000$

$$(72)_{10} \mid 2$$

$$0 \quad 36 \mid 2$$

$$0 \quad 18 \mid 2$$

$$0 \quad 9 \mid 2$$

$$1 \quad 4 \mid 2$$

$$0 \quad 2 \mid 2$$

$$(72)_{10} = (1001000)_2$$

$$133 \mid 2$$

$$1 \quad 66 \mid 2$$

$$0 \quad 33 \mid 2$$

$$1 \quad 16 \mid 2$$

$$0 \quad 8 \mid 2$$

$$0 \quad 4 \mid 2$$

$$0 \quad 2 \mid 2$$

→ Normalizar o número:

$$1,001000 \times 2^6$$

→ Gerar o expoente:

$$127 + 6 = 133$$

$$(133)_{10} = (10000101)_2$$

$$b) -201 = 1 \ 10000110 \ 100100100000000000000000$$

$$201 | 2$$

$$1 \ 100 | 2$$

$$0 \ 50 | 2$$

$$0 \ 25 | 2$$

$$1 \ 12 | 2$$

$$0 \ 6 | 2$$

$$0 \ 3 | 2$$

$$1 \ 1$$

$$134 | 2$$

$$0 \ 67 | 2$$

$$1 \ 33 | 2$$

$$1 \ 16 | 2$$

$$0 \ 8 | 2$$

$$0 \ 4 | 2$$

$$0 \ 2 | 2$$

$$0 \ 1$$

$$(201)_{10} = (11001001)_2$$

→ Normalizar o número:

$$1,1001001 \times 2^7$$

→ Guardar o expoente:

$$127 + 7 = 134$$

$$(134)_{10} = (1000110)_2$$

$$e) -8192 = 1 \ 10001100 \ 000000000000000000000000$$

$$8192 | 2$$

$$0 \ 4096 | 2$$

$$0 \ 2048 | 2$$

$$0 \ 1024 | 2$$

$$0 \ 512 | 2$$

$$0 \ 256 | 2$$

$$(8192)_{10} = (10000000000000)_2$$

→ Normalizar o número:

$$1,00000000000000 \times 2^{13}$$

→ Guardar o expoente:

$$127 + 13 = 140$$

$$(140)_{10} = (10001100)_2$$

$$140 | 2$$

$$0 \ 70 | 2$$

$$0 \ 35 | 2$$

$$1 \ 17 | 2$$

$$1 \ 8 | 2$$

$$0 \ 4 | 2$$

$$0 \ 2 | 2$$

$$0 \ 1$$

$$0 \ 128 | 2$$

$$0 \ 64 | 2$$

$$32 | 2$$

$$0 \ 16 | 2$$

$$0 \ 8 | 2$$

$$0 \ 4 | 2$$

$$0 \ 2 | 2$$

$$0 \ 1$$

$$d) - 12,35 = 1 \ 10 \ 0000 \ 10 \ 1000 \ 10 \ 1100 \ 1100 \ 1100 \ 1100 \ 1$$

$$\begin{array}{r} 12 \ 12 \\ 0 \ 6 \ 12 \\ \hline 0 \ 3 \ 12 \\ \hline 1 \ 1 \end{array}$$

$$0,35 \times 2 = 0,7$$

$$130 \ 12$$

$$0,7 \times 2 = 1,4$$

$$\begin{array}{r} 0 \ 65 \ 12 \\ 1 \ 32 \ 12 \\ \hline 0 \ 16 \ 12 \\ \hline 0 \ 8 \ 12 \\ \hline 0 \ 4 \ 12 \\ \hline 0 \ 2 \ 12 \\ \hline 0 \ 1 \end{array}$$

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

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

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

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

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

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

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

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

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

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

$$(12)_{10} = (1100)_2$$

$$(0,35)_{10} = (0,10110...)_{2}$$

$$(12,35)_{10} = (1100,010110)_{2}$$

→ Normalizar

$$1,100 \times 2^3$$

→ Guardar expoente

$$127 + 3 = 130$$

$$(130)_{10} = (10000010)_{2}$$