Prática 1

2^m	
1	2^0
2	2^1
4	2^2
8	2^3
16	2^4
32	2^5
64	2^6
128	2^7
256	2^8
512	2^9
1024	2^{10}
2048	2^{11}
4096	

1

1.1.

a) $1010111001_2 = 2^9 + 2^7 + 2^5 + 2^4 + 2^3 + 1$
$= 512 + 128 + 32 + 16 + 8 + 1$
$= 630 + 67$
$= 697$

b) $DFG_{16} = 13 \times 16^2 + 15 \times 16 + 6$
$= 13 \times 256 + 240 + 6$
$= 3328 + 246$
$= 3574$

c) $1011011\ 1101_2 = 5BD_{16} = 5 \times 16^2 + 11 \times 16 + 13$
$= 1280 + 176 + 13$
$= 1280 + 189$
$= 1469$

d) $A7A2_{16} = 10 \times 16^3 + 7 \times 16^2 + 10 \times 16 + 2$
$= 40960 + 1792 + 162$
$16^3 = 4096$ $= 40960 + 01954$
$= 42914$

e) $111\ 1111\ 1111_2 = 2^{11} - 1 = 2048 - 1 = 2047$

f) $40F0_{16} = 4 \times 16^3 + 15 \times 16 = 16384 + 240$
$= 16624$

g) $2023_8 = 2 \times 8^3 + 2 \times 8 + 3$
$= 1024 + 19$
$= 1043$

1.2

a)

1025_{10} | 16
1024 | 64 | 16
1 | 64 | 4 | 16
0 | 0 | 4
4

$1025_{10} = 401_{16} = 0100\ 0000\ 0001_2$

b) 33427_{10}

33427	2
33426	16713
1	16712
	8356
	8356
	0
	4178
	4178
	0
	2089
	2088
	1
	1044
	1044
	0
	522
	522
	0
	261
	260
	1
	130
	130
	0
	65
	64
	1
	32
	32
	0
	16
	16
	0
	8
	8
	0
	4
	4
	0
	2
	2
	0
	1
	0
	0
	1

$33427_{10} = 1000\,0010\,1001\,0011_2$

$= 8293_{16}$

c) 7543_{10}

7543	2
7542	3771
1	3770
	1885
	1884
	1
	942
	942
	0
	471
	470
	1
	235
	234
	1
	117
	116
	1
	58
	58
	0
	29
	28
	1
	14
	14
	0
	7
	6
	1
	3
	2
	1
	1
	0
	1
	0
	0

$7543_{10} = 1110\,1011\,1011_2$

$= 1D77_{16}$

d) $1\,1011\,0111_2 = 1B7_{16}$

e) $DADO_{16} = 1101\,1010\,1101\,0000_2$

f) $7254_8 = 111\,010\,101\,100_2 = EAC_{16}$

2

2.1

a)

$$\begin{array}{r} {\scriptstyle 1} \\ 1010\ 1101 \\ +1110\ 0001 \\ \hline 1100\ 1110_2 \end{array}$$

b)

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ 1\ 1\ 1} \\ 1\ 0\ 1\ 1\ 0\ 1\ 1 \\ +\ 1\ 1\ 1\ 1\ 1\ 0 \\ \hline 1\ 0\ 0\ 1\ 1\ 0\ 0\ 1 \end{array}$$

c)

$$\begin{array}{r} 125 \\ +1A7 \\ \hline 2CC_{16} \end{array}$$

d)

$$\begin{array}{r} 1\ 1\ 1\ 0\ 1\ 1_2 \\ +\quad 10\ 7_8 \\ \hline {\scriptstyle 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1} \\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1\ 1 \\ +0\ 0\ 0\ 1\ 0\ 0\ 0\ 1\ 1\ 1 \\ \hline 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0 \end{array}$$

2.2

a) 1 1 1 0 0 0 0 1

− 1 0 1 0 1 0 0 1

0 0 1 1 0 1 0 0

1+1 = 10

b) 1 0 1 1 0 1 1

− 1 0 0 1 0 0 1

0 0 1 0 0 1 0

c) 3 0 A

− 2 F F

0 0 B

d) 135_{16}

-135_8

135_{16}

$-15D_{16}$

$0D8_{16}$

$135_8 = 001\,011\,101_2 = 05D$

2.3

a)

1 1 1 0 0 0 0 1

× 1 0 0 0 1 1 0 1

1 1 1 0 0 0 0 1

0 0 0 0 0 0 0 0

1 1 1 0 0 0 0 1

1 1 1 0 0 0 0 1

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0

+ 1 1 1 0 0 0 0 1

1 1 1 0 1 1 1 1 0 0 0 0 1 0 0 0

1 1 1 0 0 0 0 1 0 0

+ 1 1 1 0 0 0 0 1

1 1 1 1 0 1 1 1 1 0 1 1 0 1

b) 25

× 17

103

25·

353_{16}

$7 \times 5 = 35 = 32 + 3 = 23_{16}$

$7 \times 4 = 28 = 16 + 12$

c) $3CA_{16}$

× 202_{16}

794

000·

+ 794·

$79B94_{16}$

$20 = 16 + 4$

$2 \times 12 = 24 = 16 + 8$

$2 \times 10 = 20 = 16 + 4$

d) $777_8 = 001\,111\,111\,111 = 1FF_{16}$

$00010111 = 17_{16}$

6 6

1 F F

× 1 7

D F 9

+ 1 F F·

2 D E 9

$15 \times 7 = 105 = 6 \times 16 + 9$

$9 + 5 = 14 = E$

$30 = 16 + 14$

$29 = 16 + 13$

3

a) $11111110_2 = -2_{10}$

b) $0000\ 0000_2 = 0_{10}$

c) $1111\ 1111_2 = -1_{10}$

d) $00110011_2 = 2^5 + 2^4 + 2 + 1 = 32 + 16 + 3 = 51_{10}$

e) $11001100_2 = -2^7 + 2^6 + 2^3 + 2^2 = -64 + 32 + 8 + 4 = -32 + 12 = -20_{10}$

f) $1000\ 1110_2 = -2^7 + 2^3 + 2^2 + 2 = -64 + 8 + 4 + 2 = -50_{10}$

4

4.1

a)

$127_{10} = 128 - 1 = 0000\ 1111\ 1111_2$

$$\begin{array}{r} 1111\ 0000\ 0000 \\ +\ \ \ \ \ \ \ \ \ \ 1 \\ \hline 1111\ 0000\ 0001 \end{array} = -127_{10}$$

b)

145	2
144	72
1	72
	0
	36
	36
	0
	18
	18
	0
	9
	8
	1
	4
	4
	0
	2
	2
	0
	1
	0
	1
	0

$145_{10} = 0000\ 1001\ 0001$

c) $5F6_{16} = 0101\ 1111\ 0110_2$

$$\begin{array}{r} 1010\ 0000\ 1001 \\ +\ \ \ \ \ \ \ \ \ \ 1 \\ \hline 1010\ 0000\ 1010 \end{array} = -576_{16}$$

d) $-(0\,1100)_2 = -(0000\ 0000\ 1100)_2$

$$\begin{array}{r} 1111\ 1111\ 0011 \\ +\ \ \ \ \ \ \ \ \ \ 1 \\ \hline 1111\ 1111\ 0100 \end{array} = -(01100)_2$$

$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$
$2^{11} = 2048$

e) $-2045 = -2^{11} + 3$
$= -2^{11} + 2^1 + 2^0$
$= 1000\ 0000\ 0011$

f)
$ABC_{16} = \underbrace{1010\ 1011\ 1100_2}_{\text{Não é representável}}$

4.2

a) $\cancel{+++}1\ 0101_2 = 10101_2$

b) $\cancel{0000}\ 1010_2 = 0\ 1010_2$

c) $+1001100_2 = \underbrace{100\ 1100_2}_{\text{Não é representável com 5 bits}}$

d) $\cancel{+++}1\ 1110_2 = 11110_2$

e) $10\ 111\ 111_2$
Não é representável em 5 bits

f) $\cancel{+++}10000_2 = 10000_2$

5

a) $-1_{10} + 63_{10} =$

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ 1\ 1\ 1\ 1} \\ 1\ 1\ 1\ 1\ \ 1\ 1\ 1\ 1 \\ +\ 0\ 0\ 1\ 1\ \ 1\ 1\ 1\ 1 \\ \hline \cancel{1}\ 0\ 0\ 1\ 1\ \ 1\ 1\ 1\ 0 \end{array}$$

b)
$123_{10} + 46_{10}$

$$\begin{array}{r} {\scriptstyle 0\ 1\ 1\ 1\ 1\ 1\ 1} \\ 0\ 1\ 1\ 1\ \ 1\ 1\ 1\ 1 \\ +\ 0\ 0\ 1\ 0\ \ 1\ 1\ 1\ 0 \\ \hline \cancel{0}\ 1\ 0\ 1\ 0\ \ 1\ 1\ 0\ 1 \end{array}$$

Overflow

$46 = 101110_2$

46	2
46	23
0	22
	1
	10
	1
	5
	4
	1
	2
	2
	0
	2
	1
	0
	2
	0
	1

c)
$12_{10} + (-124_{10})$

124	2
124	62
0	62
	0
	30
	1
	15
	14
	1
	7
	6
	1
	3
	2
	1
	1
	0
	1

$0111\ 1100 = 124_{10}$

$$\begin{array}{r} 1000\ 0011 \\ +\quad\quad\ \ 1 \\ \hline 1000\ 0100 \end{array}$$

$$\begin{array}{r} 0000\ 1100 \\ +1000\ 0100 \\ \hline 1001\ 0000 \end{array}$$

d)

125	2
124	62
1	62	2
	0	31	2
		30	15	2
		1	14	7	2
			1	6	3	2
				1	2	1	2
					1	0	2
						1	0

$125_{10} = 0111\ 1101$

$1000\ 0010$

$+\quad\quad\ 1$

$1000\ 0011 = -125_{10}$

$128_{10} = 1000\ 0000$

$0111\ 1111$

$+\quad\quad\ 1$

$1000\ 0000 = -128_{10}$

$-125_{10} + (-128_{10}) =$

$1000\ 0011$

$+1000\ 0000$

$0000\ 0011$

overflow

e)

$1111\ 1100$

-11100101

$\longrightarrow$

11111

$1111\ 1100$ (1) adicionar o 1 para o complemento

$+0001\ 1010$

00010111

f)

$10_{16} = 0000\ 1010$

$1111\ 0101$

$+\quad\quad\ 1$

$1111\ 0110 = -10_{16}$

$0000\ 1100$

$1111\ 0011$

$+\quad\quad\ 1$

$1111\ 0100 = (-01100_2)$

$1111\ 0110$

$+1111\ 0100$

$1110\ 1010_2$

6

a)

$1111\ 0000$

OR 10101011

11111011

b)

AND $1111\ 0000$

10101011

10100000

c)

$1111\ 0000$

XOR 10101011

01011011

d)

NAND $1111\ 0000$

10101011

01011111

e)

NOR $1111\ 0000$

10101011

00000100

f)

XNOR $1111\ 0000$

10101011

10100100

7

7.1

$\underbrace{x\ x\ x\ x}_{4\times4=16}$ $\quad x = b_3\ b_2\ b_1\ b_0$

binário:

1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1 $_2$
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
F				F				F				F			

decimal: $16^4 - 1 = 65\,534_{10}$

7.2

a) $101110.110010\,1_2$

$= 2^5 + 2^3 + 2^2 + 2^1 + 2^{-1} + 2^{-2} + 2^{-5} + 2^{-7}$

b)

$2B4_{16} = 2\times16^2 + 11\times16 + 4$

$\frac{4\times16^0}{2} = 2$

$= 2\times2^8 + 176 + 4$

$= 512 + 180$

$= 692 \pm 2$

$16 \times 11 = 16 + 160 = 176$

c)

$111000.1010_2 = 2^5 + 2^4 + 2^3 + 2^{-1} + 2^{-3}$

$= 32 + 16 + 8 + 0,5 + 0,125$

$= 56,625$

$\frac{1}{2^3} = \frac{1}{8} = \frac{0,5}{4} = \frac{0,25}{2} = 0,125$

d)

$2F.4_{16} = 2\times16 + 15 + 0,25 = 47,25$

$4 \times \frac{1}{16} = \frac{1}{4} = 0,25$

7.3

a) $10.25_{10} = 1010.01$

A . 4

$0,25 \times 2 = 0,50$

$0,50 \times 2 = 1,00$

$0,00 \times 2 = 0,00$

$0,25 \times 16 = 4,00$

b) $33.427_{10} = 100001.0110\,1101$

2 1 6 D

$\frac{0,001}{2} = 0,0005$

$= 21.6D$

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

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

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

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

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

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

(...)

c) $754.3_{10} = 1011110010.0100(1100)$

2 F 2 4 C

$= 2F2.4(C)$