

MAC 0329

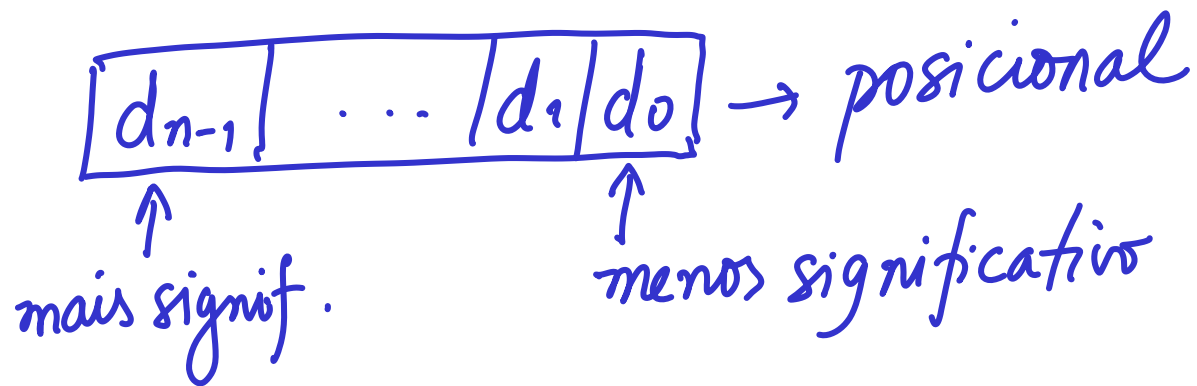
27/04/2021

# Revisão

## 1. Sistemas de representação numérica

$b$ : base       $D = \{0, 1, \dots, b-1\}$

(Exemplo:  $b=4 \Rightarrow D = \{0, 1, 2, 3\}$ )

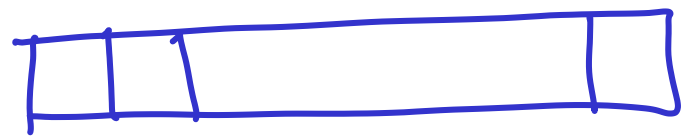


$$d_{n-1} \times b^{n-1} + \dots + d_1 b^1 + d_0 b^0 \rightarrow \text{polinomial}$$

## 2. Mudança de bases

Base  $2$ ,  $10$ ,  $8$ ,  $16$

### 3. Representação de inteiros no computador



$n$  bits

$n=32$

$n=64$

$\Rightarrow$  sinal - magnitude  $\rightarrow$  2 zeros

$\Rightarrow$  complemento de 1  $\rightarrow$  2 zeros

$\Rightarrow$  complemento de 2

$-2^{n-1}$  até  $2^{n-1} - 1$

Exemplo:  $n=3$   $-2^2$  até  $2^2 - 1 \Rightarrow -4$  a  $3$

$$n=4$$

Representação binária	Valor em decimal de acordo com as interpretações				
	$d_3 d_2 d_1 d_0$	sem sinal	sinal-magnitude	complemento de 1	complemento de 2
0000		0	0	0	0
0001		1	1	1	1
0010		2	2	2	2
0011		3	3	3	3
0100		4	4	4	4
0101		5	5	5	5
0110		6	6	6	6
0111		7	7	7	7
<u>1000</u>	8	-0	111	-7	-8
1001	9	-1	110	-6	-7
1010	10	-2		-5	-6
1011	11	-3		-4	-5
1100	12	-4		-3	-4
1101	13	-5		-2	-3
1110	14	-6		-1	-2
<u>1111</u>	15	-7		0	-1

$$\begin{array}{r} 111 \\ 1 \\ \hline 1000 = 8_{(10)} \end{array}$$

# Adição de binários

0,1 → dígitos

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

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

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

$$\begin{array}{r} 1 \ 1 \\ + \quad 1 \\ \hline 10 \end{array}$$

$$\begin{array}{r}
 0 \quad 1 \\
 0 \quad 0 \\
 0 \quad 0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 1 \quad 1 \leftarrow \text{ver-um} \\
 1 \\
 + \quad 1 \\
 \hline
 1 \quad 1
 \end{array}$$

$$\begin{array}{r}
 1 \quad 1 \quad 1 \\
 1011 \longrightarrow 11_{(10)} \\
 + \quad 0110 \longrightarrow 6_{(10)} \\
 \hline
 10001 \longrightarrow 17_{(10)}
 \end{array}$$

1
0001

↑  
overflow

compl. 2

000	0
001	1
010	2
<u>011</u>	3
100	-4
101	-3
110	-2
111	-1

$$3 + (-2) = 1_{(10)}$$

$$\begin{array}{r} 011 \\ + 110 \\ \hline \end{array}$$

$$\begin{array}{r} 1001 \\ \hline \end{array} \rightarrow 1_{(10)}$$

$$3 - 1 = 3 + (-1)$$

$$\begin{array}{r} 011 \rightsquigarrow 3 \\ + 111 \rightsquigarrow -1 \\ \hline \end{array}$$

$$\begin{array}{r} 1010 \\ \hline \end{array} \rightarrow 2$$

$$A - B = A + (-B)$$



$$2 - 3 = 2 + (-3)$$

$$\begin{array}{r} \downarrow \\ 010 \end{array} \quad 101$$

$$\begin{array}{r} + 010 \rightsquigarrow 2 \\ 101 \rightsquigarrow -3 \\ \hline \end{array}$$

$$\begin{array}{r} \boxed{1} \underbrace{11} \rightsquigarrow -1 \end{array}$$

negativo

$$\begin{array}{r} 00 \\ 1 \\ \hline 01 \rightsquigarrow 1 \end{array}$$



00	00	00	00
00	01	10	11
00	01	10	11
$0+0=0$	$0+1=1$	$0+2=2$	$0+3=3$

01	01	01	01
00	01	10	11
01	10	11	00
$1+0=1$	$1+1=2$	$1+2=3$	$1+3=0$

10	10	10	10
00	01	10	11
10	11	00	01
$2+0=2$	$2+1=3$	$2+2=0$	$2+3=1$

11	11	11	11
00	01	10	11
11	00	01	10
$3+0=3$	$3+1=0$	$3+2=1$	$3+3=2$

sem sinal

$-2 \ a \ 1$

00	00	00	00
00	01	10	11
00	01	10	11
$0+0=0$	$0+1=1$	$0+(-2)=-2$	$0+(-1)=-1$

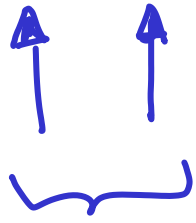
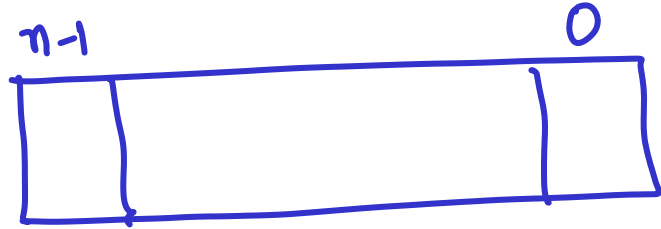
01	01	01	11
00	01	10	11
01	10	11	00
$1+0=1$	$1+1=-2$	$1+(-2)=-1$	$1+(-1)=0$

10	10	10	10
00	01	10	11
10	11	00	01
$(-2)+0=-2$	$(-2)+1=-1$	$(-2)+(-2)=0$	$(-2)+(-1)=1$

11	11	11	11
00	01	10	11
11	00	01	10
$(-1)+0=-1$	$(-1)+1=0$	$(-1)+(-2)=1$	$(-1)+(-1)=-2$

complemento de dois





nº ímpar de vai-uns  $\rightarrow$  overflow

(complemento de 2).

	compl. 2	$B = -2$	$0 - 1 = \underline{0 + (-1)}$
00	0	$0 - (-2) = 2$	
01	1	$0 + (-(-2))$	$00 \rightsquigarrow 0$
10	-2	$\downarrow$	$11 \rightsquigarrow -1$
11	-1	$\frac{00}{10}{\rule{0.5em}{0.4pt}}{10}$	$\frac{00}{11}{\rule{0.5em}{0.4pt}}{11} \rightsquigarrow -1$

$A - B$  

$A + (-B)$

$B = -2$

$\downarrow$   
10  
01  
1  

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10

$0 - 2$

-1

1  $\Rightarrow$  01

$\downarrow$  complementando

+ 10  
1  

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11

$\bar{B} + 1$

$\begin{matrix} 111 \\ 00 \end{matrix}$	$\begin{matrix} 1 \\ 00 \end{matrix}$	$\begin{matrix} 1 \\ 00 \end{matrix}$	$\begin{matrix} 1 \\ 00 \end{matrix}$
11	10	01	00
00	11	10	01
$0+(-0)=0$	$0+(-1)=-1$	$0+(-2)=-2$	$0+(-3)=-3$

$0 - 1 = 0 + (-1)$

$\begin{matrix} 111 \\ 01 \end{matrix}$	$\begin{matrix} 111 \\ 01 \end{matrix}$	$\begin{matrix} 11 \\ 01 \end{matrix}$	$\begin{matrix} 11 \\ 01 \end{matrix}$
11	10	01	00
01	00	11	10
$1+(-0)=1$	$1+(-1)=0$	$1+(-2)=-1$	$1+(-3)=-2$

$\begin{matrix} 111 \\ 10 \end{matrix}$	$\begin{matrix} 11 \\ 10 \end{matrix}$	$\begin{matrix} 111 \\ 10 \end{matrix}$	$\begin{matrix} 1 \\ 10 \end{matrix}$
11	10	01	00
10	01	00	11
$2+(-0)=2$	$2+(-1)=1$	$2+(-2)=0$	$2+(-3)=-1$

$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$
11	10	01	00
11	10	01	00
$3+(-0)=3$	$3+(-1)=2$	$3+(-2)=1$	$3+(-3)=0$

$01 \sim \underline{10} \Rightarrow \underline{10} + 1 \Rightarrow \underline{11}$

$B \quad B \quad B+1$

$\begin{matrix} 111 \\ 00 \end{matrix}$	$\begin{matrix} 1 \\ 00 \end{matrix}$	$\begin{matrix} 11 \\ 00 \end{matrix}$	$\begin{matrix} 1 \\ 00 \end{matrix}$
11	10	01	00
00	11	10	01
$0+(-0)=0$	$0+(-1)=-1$	$0+(-(-2))=2$	$0+(-(-1))=1$

$A - B = A + (-B)$

$0 \rightarrow 00$   
 $\frac{10}{10}$

$\begin{matrix} 111 \\ 01 \end{matrix}$	$\begin{matrix} 111 \\ 01 \end{matrix}$	$\begin{matrix} 11 \\ 01 \end{matrix}$	$\begin{matrix} 11 \\ 01 \end{matrix}$
11	10	01	00
01	00	11	10
$1+(-0)=1$	$1+(-1)=0$	$1+(-(-2))=1$	$1+(-(-1))=0$

$\begin{matrix} 111 \\ 10 \end{matrix}$	$\begin{matrix} 11 \\ 10 \end{matrix}$	$\begin{matrix} 111 \\ 10 \end{matrix}$	$\begin{matrix} 1 \\ 10 \end{matrix}$
11	10	01	00
10	01	00	11
$(-2)+(-0)=-2$	$(-2)+(-1)=-3$	$(-2)+(-(-2))=0$	$(-2)+(-(-1))=-1$

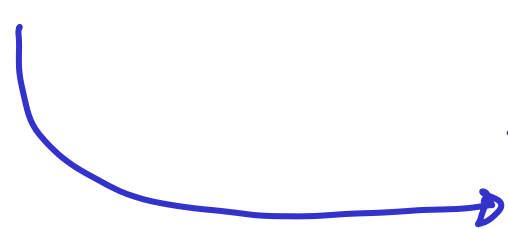
$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$	$\begin{matrix} 111 \\ 11 \end{matrix}$
11	10	01	00
11	10	01	00
$(-1)+(-0)=-1$	$(-1)+(-1)=-2$	$(-1)+(-(-2))=1$	$(-1)+(-(-1))=0$

$$B = 2$$

$$10$$

$$-2 \quad \bar{1}\bar{0} = \boxed{01} \rightarrow \bar{B}$$

①



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$$10$$

$$-B = \bar{B} + 1$$