

Système décimal : 0, 1, 2, ..., 9 10ϕ

Système binaire : 0, 1

Système octal : 0, 1, 2, ..., 7 8ϕ

Système hexadécimal : 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
A, B, C, D, E, F

Représentation polynomiale :

$$N = a_n b^n + a_{n-1} b^{n-1} + \dots + a_1 b^1 + a_0 b^0 + a_{-1} b^{-1} + \dots + a_{-n} b^{-n}$$

$$(N)_{10} = 2356,7532 = 2 \cdot 10^3 + 3 \cdot 10^2 + 5 \cdot 10^1 + 6 \cdot 10^0 + 7 \cdot 10^{-1} + 5 \cdot 10^{-2} + 3 \cdot 10^{-3} + 2 \cdot 10^{-4}$$

$$(0110,1011)_2 = \left(0 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 + 1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 1 \cdot 2^{-3} + 1 \cdot 2^{-4} \right)_{10} = (6,6875)_{10}$$

$$(6057,16)_8 = 6 \cdot 8^3 + 0 \cdot 8^2 + 5 \cdot 8^1 + 7 \cdot 8^0 + 1 \cdot 8^{-1} + 6 \cdot 8^{-2} = (3119)_{10}$$

$$N_1 = (356)_{16} = 3 \cdot 16^2 + 5 \cdot 16^1 + 6 \cdot 16^0 = (854)_{10}$$

$$N_2 = (2AF)_{16} = 2 \cdot 16^2 + 10 \cdot 16^1 + 15 \cdot 16^0 = (687)_{10}$$

$$N_3 = (81.B)_{16} = 8 \cdot 16^1 + 1 \cdot 16^0 + 11 \cdot 16^{-1} = (129,6875)_{10}$$

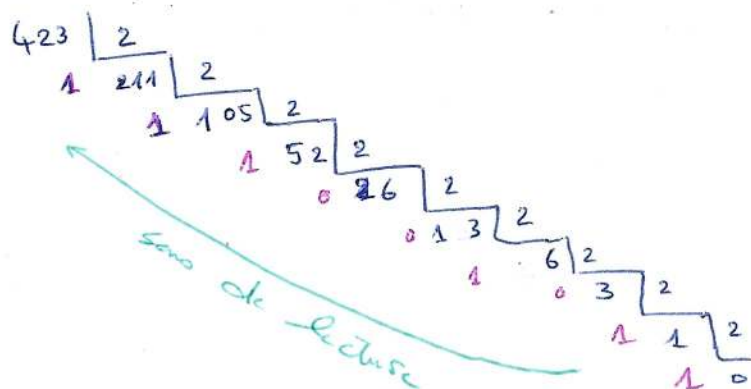
Changement de base :

1) base $N \rightarrow$ base 10 : Forme polynomiale -

base 2 $\leftarrow$ base 8 $\leftarrow$ base 16

base 10 $\rightarrow$ base b
 $2 \leftarrow 2 \leftarrow 16$

$$(423)_{10} \rightarrow \text{base 2} \\ = 110100111$$



$$\begin{array}{r|l} 423 & 8 \\ \hline 7 & 52 \\ & 4 \\ & 6 \\ & 6 \\ & 0 \end{array}$$

$$(423)_{10} = (647)_8$$

$$(423)_{10} = (167)_{16}$$

$$\begin{array}{r|l} 423 & 16 \\ \hline \end{array}$$

$$(58, 32)_{10} \rightarrow \text{base 2}$$

$$\begin{array}{r} 58 \div 2 = 29 \text{ r } 0 \\ 29 \div 2 = 14 \text{ r } 1 \\ 14 \div 2 = 7 \text{ r } 0 \\ 7 \div 2 = 3 \text{ r } 1 \\ 3 \div 2 = 1 \text{ r } 1 \\ 1 \div 2 = 0 \text{ r } 1 \end{array}$$

- On commence par la conversion de $(58)_{10} \rightarrow \text{base 2}$
 $(58)_{10} = (111010)_2$

- On fait multiplication successive de $(0,32)$

$$\begin{array}{r} 0,32 \\ \times 2 \\ \hline 0,64 \end{array} \quad \begin{array}{r} 0,64 \\ \times 2 \\ \hline 1,28 \end{array} \quad \begin{array}{r} 1,28 \\ \times 2 \\ \hline 2,56 \end{array} \quad \begin{array}{r} 2,56 \\ \times 2 \\ \hline 5,12 \end{array} \quad \begin{array}{r} 5,12 \\ \times 2 \\ \hline 10,24 \end{array}$$

→ sens de lecture

$$\Rightarrow (58,32)_{10} = 111010,01010$$

Autre types de conversions:

Conversion octal $\rightarrow$ binaire

$$(273)_8 = (010 \ 111 \ 101)_2$$

$$(57,31)_8 = (101 \ 111 \ 011 \ 001)_2$$

Conversion hexadecimal $\rightarrow$ binaire

$$(9B2)_{16} = (1001 \ 1011 \ 0010)_2$$

$$(C3,4F)_{16} = (1100 \ 0011, 0100 \ 1111)_2$$

Operation arithmétique:

Notion de complément à 2

$$N = 10010100$$

$$1+1=2 \rightarrow 10$$

$$\begin{array}{r} \text{Complément à 1 de N} \\ 01101011 \\ + \\ \hline \end{array}$$

$$\begin{array}{r} \text{Complément à 2 de N} \\ 01101011 \\ + \\ \hline 01101100 \end{array}$$

On commence à droite et lorsqu'on trouve 1 on commence à inverser c-a-d faire un complément de 1.

0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Value decimal Nombre binaire en complément à 2

7	0 1 1 1
6	0 1 1 0
5	0 1 0 1
4	0 1 0 0
3	0 0 1 1
2	0 0 1 0
1	0 0 0 1
0	0 0 0 0
-1	1 1 1 1
-2	1 1 1 0
-3	1 1 0 1
-4	1 1 0 0
-5	1 0 1 1
-6	1 0 1 0
-7	1 0 0 1
-8	1 0 0 0

addition non signée: (pas de bit de signe)

$$\begin{array}{r}
 (1010)_2 \rightarrow 0 \cdot 2^0 + 1 \cdot 2^1 + 0 \cdot 2^2 + 1 \cdot 2^3 = (10)_{10} \\
 + (0111)_2 \rightarrow 1 \cdot 2^0 + 1 \cdot 2^1 + 1 \cdot 2^2 + 0 \cdot 2^3 = (7)_{10} \\
 \hline
 (10001)_2 \rightarrow (17)_{10}
 \end{array}$$

addition signée (présence d'un bit de signe)

$$\begin{array}{r}
 (01001)_2 \rightarrow (5)_{10} \\
 + (00100)_2 \rightarrow (4)_{10} \\
 \hline
 (01101)_2 \rightarrow (13)_{10}
 \end{array}$$

$$\begin{array}{r}
 1 \ 0 \ 1 \ 0 \ 0 \ 1 \rightarrow (5)_{10} \\
 + 1 \ 1 \ 1 \ 0 \ 0 \rightarrow (-4)_{10} \\
 \hline
 \cancel{1} \ 0 \ 0 \ 1 \ 0 \ 1 \rightarrow (5)_{10}
 \end{array}$$

complément à 2 de 4

on ne conserve pas le dépassement

$$(-9)_{10} + (-4)_{10} \Rightarrow$$

$$\begin{array}{r}
 1 \ 1 \ 0 \ 1 \ 1 \ 1 \rightarrow (-3)_{10} \\
 + 1 \ 1 \ 1 \ 0 \ 0 \rightarrow (-4)_{10} \\
 \hline
 \cancel{1} \ 1 \ 0 \ 0 \ 1 \ 1
 \end{array}$$

complément à 2 de 3 → $01101 \rightarrow (13)_{10}$

$$\begin{array}{r}
 (778)_{10} \\
 + (125)_{10} \\
 \hline
 (903)_{10}
 \end{array}$$

$$\begin{array}{r}
 (53)_H \\
 + (88)_H \\
 \hline
 (DB)_H
 \end{array}$$

$$\begin{array}{r}
 (54)_H \\
 + (18)_H \\
 \hline
 (FC)_H
 \end{array}$$

$$\begin{array}{r}
 (3AF)_H \\
 + (43C)_H \\
 \hline
 (7EB)_H
 \end{array}$$

$$\begin{array}{r}
 F \rightarrow 15 \\
 C \rightarrow 12 \\
 \hline
 27 \\
 - 16 \\
 \hline
 11
 \end{array}$$

$$\begin{array}{r}
 CAFE \\
 CAFE \\
 \hline
 (195FC)_H
 \end{array}$$

Hexa → non signée

$$\begin{array}{r}
 (753)_{10} \\
 - (592)_{10} \\
 \hline
 161
 \end{array}$$

$$\begin{array}{r}
 (16)_{10} \\
 B \rightarrow 11 \\
 C \rightarrow 5 \\
 \hline
 (592)_{10} \\
 - (753)_{10} \\
 \hline
 609
 \end{array}$$

$$\begin{array}{r} \textcircled{1} \textcircled{2} \textcircled{3} \textcircled{4} \\ 1BCE)_H \\ - 7D5)_H \\ \hline 0DF9)_H \end{array}$$

$$\begin{array}{r} \textcircled{1} \textcircled{2} \textcircled{3} \textcircled{4} \\ AB429 \\ - 9D7A \\ \hline 174F \end{array}$$

Les codes:

Code BCD (Binary coded Decimal)

Code decimal	Code BCD
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

$$(874)_{10} \rightarrow (1000 \ 0111 \ 0100)_{BCD}$$

Code decimal	Code binaire	Code Gray
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101
10	1010	1111
11	1011	1110
12	1100	1010
13	1101	1011
14	1110	1001
15	1111	1000

Dans le code Gray
1 seul bit change
chaque fois

Conversion binaire $\rightarrow$ Gray

$$\begin{array}{ccccccc} + & + & + & + & + \\ 1 & 1 & 0 & 1 & 0 & 1 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & 1 & 1 & 1 & 1 \end{array} \rightarrow 101111$$

$$\begin{array}{l} \text{si } \textcircled{A} = \textcircled{B} \text{ on met } 0 \\ \text{si } \textcircled{A} \neq \textcircled{B} \text{ on met } 1 \end{array}$$

Conversion Gray $\rightarrow$ binaire

$$\begin{array}{ccccccc} 1 & 1 & 0 & 1 & 0 & 1 \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 1 & 0 & 0 & 1 & 0 & 1 \end{array} \rightarrow 100101$$