

TD1 : Architecture

Exercice 1:

1)

$$58_{10} \begin{array}{r} | \\ 111010_2 \\ | \\ 000000\ 0001\ 11010_2 \end{array}$$

$$58_{10} = 111010_2$$

$$= 000000\ 0001\ 11010_2$$

$$58_{10} = 0000\ 0000\ 0011\ 1010_2 \text{ (cà 2)} \\ = 0\ 0\ 3\ A\ H$$

$$-2_{10} = 0000\ 0000\ 0000\ 0010_2$$

$$= 1111\ 1111\ 1111\ 1101 \\ + 1 \text{ (cà 2)}$$

$$\overline{1111\ 1111\ 1111\ 1110} \\ F\ F\ F\ E\ H$$

$$-32 = ?$$

$$32 \begin{array}{r} | \\ 016 \\ | \\ 08 \\ | \\ 04 \\ | \\ 02 \\ | \\ 01 \\ | \\ 00 \end{array}$$

$$32_{10} = 100000_2$$

$$= 0000\ 0000\ 0010\ 0000_2$$

$$= 1111\ 1111\ 1101\ 1111$$

$$+ 1 \\ \overline{1111\ 1111\ 1110\ 0000} \text{ (cà 2)} \\ = F\ F\ E\ O\ H$$

$32768 = ?$
On ne peut pas représenter le nombre
 32768 sur 16 bit puisque
 $32768 \notin [-32768, 32767]$

$$\left. \begin{array}{l} X \text{ nbit} \\ x \in [-2^{n+1}, 2^{n-1} - 1] \\ x \in [-2^{15}, 2^{15} - 1] \\ x \in [-32768, 32767] \end{array} \right\}$$

$$\begin{aligned} -32768 &= 1000\ 0000\ 0000\ 0000_2 \\ &= 0111\ 1111\ 1111\ 1111 \\ + 1 &= \overline{1000\ 0000\ 0000\ 0000} \\ &= 8\ 0\ 0\ 0\ H \end{aligned}$$

95000 (10) on ne peut pas représenter

95000 sur 16 bit puisque $95000 \notin 2^{15}, 2^{15} - 1$

2)

$$\begin{aligned} * FFFF\ H &= 1111\ 1111\ 1111\ 1111 \\ &\quad 0000\ 0000\ 0000\ 0000 \text{ (cà 2)} \\ + 1 &= \overline{0000\ 0000\ 0000\ 0001} \\ &= -1 \text{ (10)} \end{aligned}$$

$$\begin{aligned} * 0041\ H &= 0000\ 0000\ 0100\ 0001 \text{ (cà 2)} \\ &= 0 \cdot 2^{15} + 0 \cdot 2^{14} + 1 \cdot 2^6 + 0 \cdot 2^5 \\ &\quad + \dots + 1 \cdot 2^0 = 64 + 1 = 65 \text{ (10)} \end{aligned}$$

$$\begin{aligned} * 8000\ H &= 1000\ 0000\ 0000\ 0000 \\ &\quad 0111\ 1111\ 1111\ 1111 \text{ (cà 2)} \\ + 1 &= \overline{1000\ 0000\ 0000\ 0001} \\ &= -32768 \text{ (10)} \end{aligned}$$

$$\begin{aligned} * FFBF\ H &= 1111\ 1111\ 1011\ 1111 \\ &\quad 0000\ 0000\ 0100\ 0000 \text{ (cà 2)} \\ + 1 &= \overline{0000\ 0000\ 0100\ 0001} \\ &= -65 \text{ (10)} \end{aligned}$$

Conversion réel :

Binaire \rightarrow Decimal

$$(101,11)_2 = 2^3 + 2^0 + 2^1 + 2^2 \\ = 4 + 1 + 0,5 + 0,25 = 5,75$$

Decimal \rightarrow Binaire

$$(32,625) = (100000, 101)_2$$

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

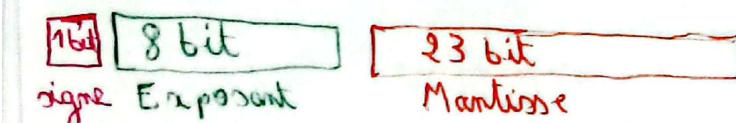
$$0,25 \times 2 = 0,5$$

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

Virgule Flottante :

$$\begin{array}{c} (100000, 101)_2 = 1,00000101 \times 2^{+5} \\ \xrightarrow{\quad\quad\quad} \quad\quad\quad = 10000010,1 \times 2^{-2} \end{array}$$

IEEE 754 simple precision (32 bit)

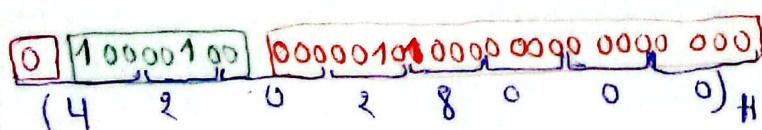


$$\text{signe } \begin{cases} 0 & + \\ 1 & - \end{cases}$$

$$\text{Exposant : } 127 + 5 = (132)_{10} = (1000100)_2$$

Mantisse : 00000101

1, Mantisse
0, Mantisse

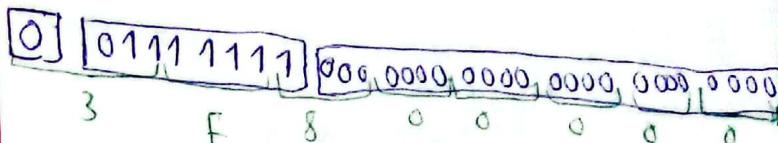


$$(1)_{10} = (1)_2 = 1,0 \times 2^0$$

$$\text{signe} = 0$$

$$\text{Exposant} = 127 + 0 = (01111111)_2$$

$$\text{Mantisse} = 0$$



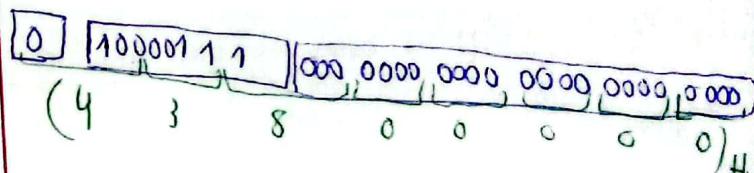
$$(256)_{10} = (100000000)_2 = 1,00000000 \times 2^{+8}$$

$$\text{signe} = 0$$

$$\text{Exposant} = 127 + 8 = (135)_{10}$$

$$= (1000111)_2$$

$$\text{Mantisse} = 0 \quad 0$$



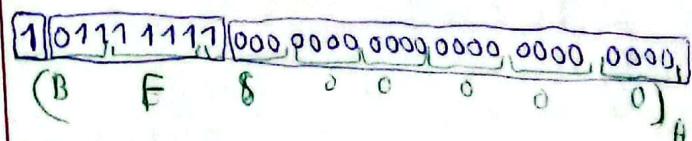
$$(-1)_{10} = 1$$

$$(1)_{10} = (1)_2 = 1,0 \times 2^0$$

$$\text{signe} = 1$$

$$\text{Exposant} = 127 = (01111111)_2$$

$$\text{Mantisse} = 0$$

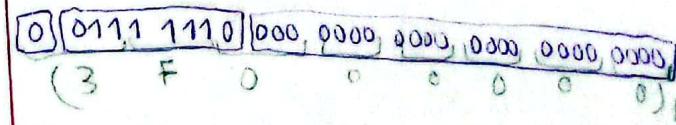


$$0,5 = (0,1)_2 = 1,0 \times 2^{-1}$$

$$\text{signe} = 0$$

$$\text{Exposant} = 127 - 1 = (126)_{10} = (0111110)_2$$

$$\text{Mantisse} = 0$$



$$16,875 = (10000,111)_2 = 1,0000111 \cdot 2^4$$

$$0,875 \times 2 = \boxed{1},75$$

$$0,75 \times 2 = \boxed{1},5$$

$$0,5 \times 2 = \Rightarrow \boxed{1}$$

signe 0

$$\text{Exponent} = 127 + 4 = (131)_{10} = (1000 \quad 0011)_2$$

$$\text{Mantisse} = 0000111$$

$$0 \boxed{10000011} \boxed{000,0111,0000,0000,0000,0000}_2 \\ (4 \quad 1 \quad 8 \quad 7 \quad 6 \quad 5 \quad 4 \quad 3 \quad 2 \quad 1 \quad 0)_2$$

2)

$$(C0400\ 000)_H$$

$$\boxed{1} \boxed{1000\ 000\ 00} \boxed{100\ 0000\ 0000\ 0000\ 0000\ 0000}_2$$

signe 1

$$\text{Exponent} = 128$$

$$\text{Mantisse} = 1$$

$$\text{Valeur} = (-1)^{\text{signe}} \times 2^{(\text{Exponent} - 127)}$$

$$\times 1, \text{Mantisse} \\ = (-1)^1 \times 2^{(128 - 127)} \times (1,1)_2$$

$$= -1 \times 2^1 \times 1,1 = \boxed{-3}$$

$$2^1 \times (1,1)_2 = (1,1)_2 \times -1 = -2 \times 1 = \boxed{-3}$$

$$(-38\ 00000)_2$$

$$\boxed{1} \boxed{100\ 0011} \boxed{1} \boxed{000\ 0000\ 0000\ 0000\ 0000}_2$$

signe 1 Exponent = 135

$$\text{Mantisse} = 0$$

$$\text{Valeur} = (-1)^1 \times 2^{(135 - 127)}$$

$$= -1 \times 2^8 \times 1,0 \times 1,0$$

$$= -1 \times 2^8 \times 1 = -256$$

$$1 \times (1,0,2^8) = 10000\ 0000 = -256$$