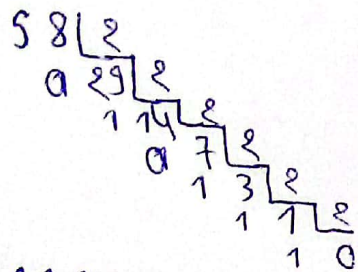


Exercice 1:

Exercice 1:

11



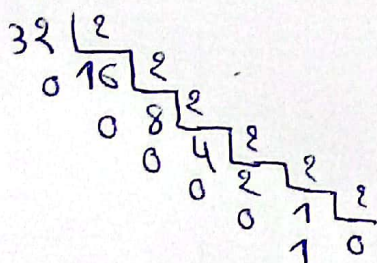
$$58_{10} = 111010_2$$

$$= 000000\ 00001\ 11010_2$$

$58_{10} = 0000 \ 0000 \ 0011 \ 1010_2 \text{ (cdz)}$
 $= \quad \quad \quad 3 \quad \quad A \quad H$

$$\begin{array}{r}
 -2_{10} = 0000 \ 0000 \ 0000 \ 0010_2 \\
 = 1111 \ 1111 \ 1111 \ 1101 \\
 + \qquad \qquad \qquad 1 \quad (\text{carry}) \\
 \hline
 1111 \ 1111 \ 1111 \ 1110 \\
 \text{F} \quad \text{F} \quad \text{F} \quad \text{E} \quad \text{H}
 \end{array}$$

$$-32 = ?$$



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

$$= 0000\ 0000\ 0010\ 0000_{(2)}$$

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

$$= \begin{array}{ccccccccc} & + & & & & & & & 1 \\ \hline = & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & \text{(Carry)} \\ & F & & & F & & E & & O & & H & & & \end{array}$$

$32768 = ?$
But

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

$$32768 \notin [-32768, 32767]$$

x nbit
 $x \in [-2^{n+1}, 2^{n+1} - 1]$
 $x \in [-2^{15}, 2^{15} - 1]$
 $x \in [-32768, 32767]$

$$\begin{array}{r}
 -32768 = 1000\ 0000\ 0000\ 0000_{(2)} \\
 = 0111\ 1111\ 1111\ 1111 \\
 + \qquad \qquad \qquad 1 \\
 \hline
 = 1000\ 0000\ 0000\ 0000 \\
 = 8\ 0\ 0\ 0\ 11
 \end{array}$$

95 000 (10) on ne peut pas représenter
95 000 sur 16 bits puisque $95\,000 \notin 2^{15}, 2^{16}$

2)

* $FFFF\ H = 1111\ 1111\ 1111\ 1111$
 $0000\ 0000\ 0000\ 0000\ (C00)$
 $+$
 $= 0000\ 0000\ 0000\ 0001\ (1)$
 $= -1\ (10)$

$$\begin{aligned} * 0041H &= 0000 \ 0000 \ 0100 \ 0001 \quad (ca)_{16} \\ &= 0 \times 2^{15} + 0 \times 2^{14} + \dots + 1 \times 2^6 + 0 \times 2^5 \\ &\quad + \dots + 1 \times 2^0 = 64 + 1 = 65_{(10)} \end{aligned}$$

* $8000_{10} = 1000\ 0000\ 0000\ 0000$
 $\quad\quad\quad 0111\ 1111\ 1111\ 1111_{(2)} \quad (c \oplus e)$
 $\quad\quad\quad +$
 $\quad\quad\quad \hline$
 $\quad\quad\quad = 1000\ 0000\ 0000\ 0000$
 $\quad\quad\quad = -32768_{(10)}$

$$\begin{array}{r} \times \text{FFBFH} = 1111\ 1111\ 1011\ 1111 \\ 0000\ 0000\ 0100\ 0000 \\ \hline = 0000\ 0000\ 0100\ 0001 \\ = -65_{(10)} \end{array}$$

Conversion need:

Binaire → Decimal

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

Decimale → Binaire

$$(32,625)_{10} = (100000,101)_2$$

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

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

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

Virgule Flottante:

$$(100000,101)_2 = 1,00000101 \times 2^{+5} \\ = 10000010,1 \times 2^{+2}$$

IEEE 754 simple precision (32 bit)



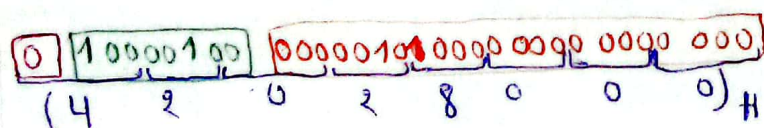
$$\text{signe} \begin{cases} 0 & + \\ 1 & - \end{cases}$$

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

$$\text{Mantisse} : 0000101$$

$$1, \text{Mantisse}$$

$$0, \text{Mantisse}$$

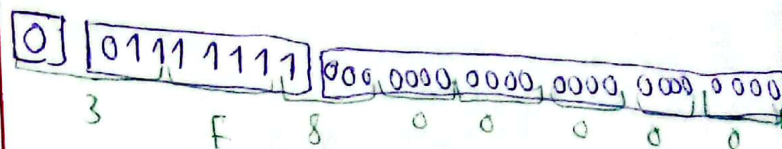


$$(1)_{10} = (1)_2 = 1,0 \times 2^0$$

$$\text{signe} = 0$$

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

$$\text{Mantisse} = 0$$



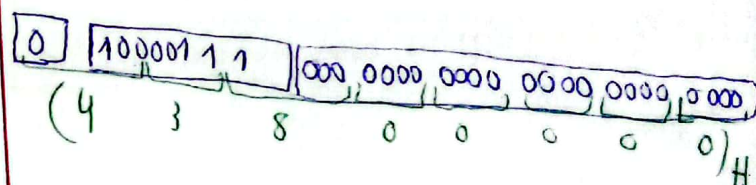
$$(256)_{10} = (100000000)_2 = 1,00000000 \times 2^8$$

$$\text{signe} = 0$$

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

$$= (10000111)_2$$

$$\text{Mantisse} = 0$$



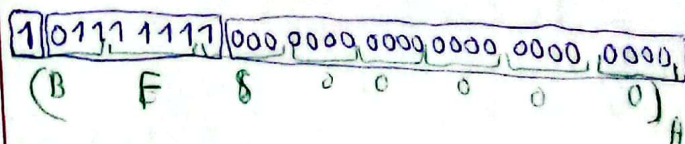
$$(-1)_{10} = 1$$

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

$$\text{signe} = 1$$

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

$$\text{Mantisse} = 0$$

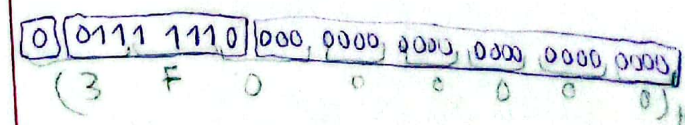


$$0,5 = (0,1)_2 = 1,0 \times 2^{-1}$$

$$\text{signe} = 0$$

$$\text{Exposant} = 127 - 1 = (126)_{10} = (01111110)_2$$

$$\text{Mantisse} = 0$$



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

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

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

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

signe: 0

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

$$\text{Mantisse} = 0000111$$

$$\boxed{0} \boxed{10000011} \boxed{000\ 0111\ 0000\ 0000\ 0000\ 0000}$$

(4 1 8 7 0 0 0 0)₁₆

2)

$$(C0400\ 000)_{16}$$

$$\boxed{1} \boxed{1000\ 0000} \boxed{100\ 0000\ 0000\ 0000\ 0000\ 0000}$$

signe: 1

$$\text{Exposant} = 128$$

$$\text{Mantisse} = 1$$

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

$\times 1, \text{Mantisse}$

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

$$= -1 \times 2^1 \times 1,5 = \boxed{-3}$$

$$2^1 \times (1,1)_2 = \left(\overset{2^1}{1} \overset{2^0}{1} \right)_2 \times -1 = 3 \times -1 = \boxed{-3}$$

$$C38\ 00000$$

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

signe: 1 Exposant: -135

$$\text{Mantisse} = 0$$

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

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

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

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