

# Format portabil IEEE 754

- Reprezentarea n. în virgulă flotantă

$$X = X_m * B^{x_E}$$

$\downarrow$  mantisa       $\downarrow$  baza       $\downarrow$  exponent

$$N = 0.55 \quad (8 \text{ bit})$$

$$N' = .10001100$$

$$N' = 0.546875$$

$$\epsilon = N - N' = 0.003125$$

$$0.55 \cdot 2$$

$$1.10 \cdot 2 \quad 1$$

$$0.20 \cdot 2 \quad 0$$

$$0.40 \cdot 2 \quad 0$$

$$0.80 \cdot 2 \quad 0$$

$$1.60 \cdot 2 \quad 1$$

$$1.20 \cdot 2 \quad 1$$

$$0.40 \cdot 2 \quad 0$$

$$N'' = .1000110011001100 \quad (16 \text{ bit})$$

$$N'' = 0.54998779296875$$

$$\xi'' = 0.00001220703125 \quad \underline{\underline{\xi' > \xi''}}$$

$$\boxed{x_{n-1} \mid x_{n-2} \mid \dots \mid x_1 \mid x_0} \rightarrow \text{Integ}$$

$2^{n-2} \qquad \qquad \qquad 2^1 \quad 2^0$

Sigm

↑ precision  
↓ range

$$X_M = S \cdot X_M^*$$

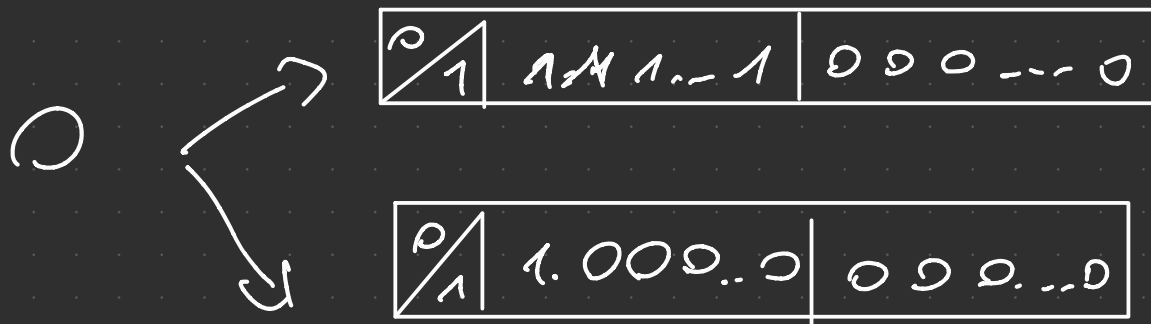
S	$X_E$	$X_M$
---	-------	-------

$X_E$ 

 $\nearrow$   
 $\searrow$ 

 $SM := -2^{n-1} + 1$   
 $CL := -2^{n-1}$ 

 $111\dots 1$   
 $1000\dots 0$



bias  $\begin{cases} 2^{n-1} - 1 \\ 2^{n-1} \end{cases}$  SM  
C2

$$SM: X_E \in [1 - 2^{n-1}; 2^{n-1} - 1] \rightarrow$$

$$\xrightarrow{+2^{n-1}} [0, 2^n - 1]$$

$$C2: X_E \in [-2^{n-1}; 2^{n-1} - 1] \xrightarrow{+2^{n-1}}$$

$$\rightarrow [0, 2^n - 1]$$

$$0.110 = 110 \cdot 2^{-3}$$

$$= 0.0110 \cdot 2$$

→ MSB al Exponentului

$$+\frac{7}{8} = 0.111_{SM}$$

$$-\frac{7}{8} = 1.111_{SM}$$

$$\frac{1}{2} \leq |x_m| < 1$$

S	$X_E$	$x_m$
---	-------	-------

<1> <8>

<23>

bias 127 (SM)

128 C2

$$X_S = 1. X_S^*$$

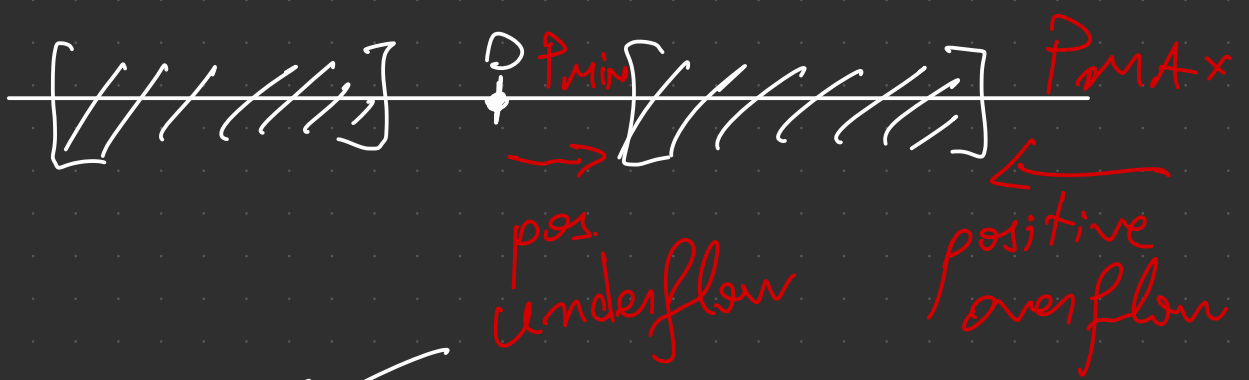
$$1 \leq X_S < 2$$

$$x_m = 0. x_m^*$$

+1 bit pt. mantisa

hidden bit  $\uparrow \dots$

$$X = (-1)^S \times 2^{X_E - \text{exces}} \times (1. X_S^*)$$



val. atât de mică (nu poate fi repr.)

$P_{\max}$

0 | 1111110 | . 111... - - - 1

$$P_{\max} = (-1)^0 \times 2^{254-127} \times 1.11...1$$

↔  
23

$$P_{\max} = 2^{127} \left( 2 - 2^{-23} \right) \approx 3.4 \times 10^{38}$$

$10_{(2)} = 2.00...01$   
↔  
 $2^{-23}$

$P_{\min}$

0 | 00000000 | . 000...0

$$P_{\min} = (-1)^0 \times 2^{1-127} \times (1.00...0)$$

$$\approx 2^{-126} \approx 1.18 \cdot 10^{-38}$$

$\text{Not a number} \rightarrow \text{Not a number}$

$$X_E = X_{E_{\max}} = 255$$

$$X_S^* \neq 0$$

$$\pm \infty \quad a=b = \frac{P_{\max}}{\sqrt{2}}$$

$$\sqrt{a^2 + b^2} = \sqrt{\frac{P_{\max}^2}{2} + \frac{P_{\max}^2}{2}} \quad \text{flush to } P_{\max}$$

$$= \sqrt{\frac{P_{\max}}{2} + \frac{P_{\max}}{2}} = \sqrt{P_{\max}}$$

$$X_E = X_{E_{\max}} = 255$$

$$X_S^* = 0$$

$$c) \neq 0 \quad x_E = x_{E_{min}} = 0$$

$$x_S^* = 0$$

$$x_\Delta = (-1)^s \times 2^{1-\text{bias}} \times (0.x_S^*)$$

75.046875

Repr. IEEE 754

hidden bit

$$(1)001011.000011 \times 2^0$$

$$0.046875 \cdot 2$$

$$0.093750 \cdot 2 \quad 0$$

$$0.187500 \cdot 2 \quad 0$$

$$0.375000 \cdot 2 \quad 0$$

$$0.750000 \cdot 2 \quad 0$$

$$1.500000 \cdot 2 \quad 1$$

$$1.000000 \quad 1$$

$$= 1.001011000011$$

$$\times 2^6$$

$$X_E = 6 + \text{bias} = 6 + 127 = 10000101$$

$$X_S^* = .001011000011 \dots 0 \quad (23)$$

0	10000101	001011000011000	0
	4	21961810	0

C 1 A E 0000 16

1 1 00 000 1 0101 1100 0 --- 0

$$X = (-1)^S * 2^{X_E - 127} (1.X_S^*)$$

Format IBM

bits in excess  
de 64  $2^{7-1}$

→ base 16

$$16^{X_E} = 2^{4 * X_E}$$

S	$X_E$	$X_M^*$
<1>	<7>	<24>



$$75.046875 = \underbrace{01001011}_{16^0} \cdot 16^0$$

$$0.01001011000011 \times 16^2$$

$$X_E = 2 + 64 = 66 = 1000010$$

$$X_M^* = 010010110000110 \dots 0 \quad (24)$$

0	1000010	01001011	00001100	...0
	4	2	4	B
			0	C
			0	0

$$C1AE0000 \rightarrow$$

$$\rightarrow \underbrace{11000001}_{X_E = 65} \mid \underbrace{1010}_{16^1} \mid \underbrace{1110}_{16^2} \mid \dots$$

$$X = (-1)^1 \cdot 16^{65-64} \times (0.1010111)$$

$$= -2^4 \times 0.1010111 = -10,875$$

# Cap. 2

Analiza funcțională și  
sinteza dispozitivelor de adunare  
și scădere, binară și zecimală

## 2.1) Sumator serial

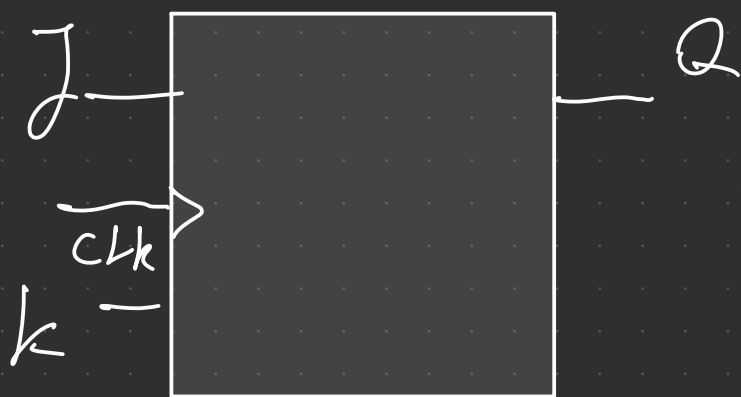
$$\begin{array}{l} X = x_{n-1} \ x_{n-2} \ \dots \ \left( \begin{array}{c} x_1 \\ x_0 \end{array} \right) \\ Y = y_{n-1} \ y_{n-2} \ \dots \ \left( \begin{array}{c} y_1 \\ y_0 \end{array} \right) \end{array}$$

Avantaje :

- Suprafață ↓
- Consum Energy ↓
- Frecv. operare ↑

Dezavantaje • Latență rezultat final ↑

↗ LSDF (Least significant digit first)  
↘ MSDF (Most....)



$$Q(t+1) = J \overline{Q(t)} + \overline{K} Q(t)$$

set      reset

$Q(t)$	$Q(t+1)$	J	K
0	0	0	*
0	1	1	*
1	0	*	1
1	1	*	0

in w	x, y			
	0, 0	0, 1	1, 1	1, 0
0	0 / 0	0 / 1	1 / 0	0 / 1
1	0 / 1	1 / 0	1 / 1	1 / 0

in				out	
w	x	y	z	k	z
0	0	0	0	*	<del>0</del>
0	0	1	0	*	1
0	1	0	0	*	1
0	1	1	1	*	0
1	0	0			

$$a \cdot b + c \cdot d = \overline{a \cdot b} \cdot \overline{c \cdot d}$$

NAND GATES