

Organización de Computadoras

TP 3: Punto Flotante

Curso 2020
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$$a) M \begin{cases} \text{fraccionaria} \\ \text{BSS 6 bits} \end{cases} \quad E \begin{cases} \text{BCS} \\ 4 \text{ bits} \end{cases}$$

$$\underbrace{010111}_M \underbrace{0110}_E \Rightarrow 0,010111 \times 2^{0110} = (2^{-2} + 2^{-4} + 2^{-5} + 2^{-6}) \times 2^6 = 2^4 + 2^2 + 2^1 + 2^0 =$$

$$= 16 + 4 + 2 + 1 = 23 \quad \Leftarrow$$

$$\underbrace{000001}_M \underbrace{0000}_E \Rightarrow 0,000001 \times 2^{0000} = (2^{-6}) \times 2^0 = 2^{-6} \quad \Leftarrow$$

$$\underbrace{000011}_M \underbrace{1001}_E \Rightarrow 0,000011 \times 2^{1001} = (2^{-5} + 2^{-6}) \times 2^{-1} = 2^{-6} + 2^{-7} \quad \Leftarrow$$

$$\underbrace{111111}_M \underbrace{1111}_E \Rightarrow 0,111111 \times 2^{1111} = (2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6}) \times 2^{-7} =$$

$$= 2^{-8} + 2^{-9} + 2^{-10} + 2^{-11} + 2^{-12} + 2^{-13} \quad \Leftarrow$$

$$\underbrace{000000}_M \underbrace{0000}_E \Rightarrow 0,000000 x 2^{0000} = 0 x 2^0 = 0 \quad \Leftarrow$$

$$\underbrace{000000}_M \underbrace{1111}_E \Rightarrow 0,000000 x 2^{1111} = 0 x 2^{-7} = 0 \quad \Leftarrow$$

$$\begin{aligned} \underbrace{111111}_M \underbrace{0000}_E &\Rightarrow 0,111111 x 2^{0000} = (2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6}) x 2^0 = \\ &= 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5} + 2^{-6} \quad \Leftarrow \end{aligned}$$

$$\underbrace{100000}_M \underbrace{0000}_E \Rightarrow 0,100000 x 2^{0000} = 2^{-1} x 2^0 = 0,5 \quad \Leftarrow$$

$$\underbrace{000001}_M \underbrace{1111}_E \Rightarrow 0,000001 x 2^{1111} = 2^{-6} x 2^{-7} = 2^{-13} \quad \Leftarrow$$

$$a) M \begin{cases} \text{fraccionaria} \\ \text{BCS 6 bits} \end{cases} \quad E \begin{cases} \text{BCS} \\ 4 \text{ bits} \end{cases}$$

$$\begin{aligned} \underbrace{0}_{\check{S}} \underbrace{10111}_M \underbrace{0110}_E &\Rightarrow 0,0,10111 x 2^{0110} = +(2^{-1} + 2^{-3} + 2^{-4} + 2^{-5}) x 2^6 = +(2^5 + 2^3 + 2^2 + 2^1) = \\ &= 32 + 8 + 4 + 2 = 46 \quad \Leftarrow \end{aligned}$$

$$\underbrace{0}_{\check{S}} \underbrace{00001}_M \underbrace{0000}_E \Rightarrow 0,0,00001 x 2^{0000} = +(2^{-5}) x 2^0 = +2^{-5} \quad \Leftarrow$$

$$\underbrace{0}_{\check{S}} \underbrace{00011}_M \underbrace{1001}_E \Rightarrow 0,0,00011 x 2^{1001} = +(2^{-4} + 2^{-5}) x 2^{-1} = +(2^{-5} + 2^{-6}) \quad \Leftarrow$$

$$\begin{aligned} \underbrace{1}_{\check{S}} \underbrace{11111}_M \underbrace{1111}_E &\Rightarrow 1,0,11111 x 2^{1111} = -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5}) x 2^{-7} = \\ &= -(2^{-8} + 2^{-9} + 2^{-10} + 2^{-11} + 2^{-12}) \quad \Leftarrow \end{aligned}$$

$$\underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{00000}_{\substack{\uparrow \\ M}} \underbrace{0000}_{\substack{\uparrow \\ E}} \Rightarrow 0\,0,00000 \times 2^{0000} = +0 \times 2^0 = 0 \quad \Leftarrow$$

$$\underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{00000}_{\substack{\uparrow \\ M}} \underbrace{1111}_{\substack{\uparrow \\ E}} \Rightarrow 0\,0,00000 \times 2^{1111} = +0 \times 2^{-7} = 0 \quad \Leftarrow$$

$$\begin{aligned} \underbrace{1}_{\substack{\uparrow \\ S}} \underbrace{11111}_{\substack{\uparrow \\ M}} \underbrace{0000}_{\substack{\uparrow \\ E}} &\Rightarrow 10,11111 \times 2^{0000} = -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5}) \times 2^0 = \\ &= -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5}) \quad \Leftarrow \end{aligned}$$

$$\underbrace{1}_{\substack{\uparrow \\ S}} \underbrace{00000}_{\substack{\uparrow \\ M}} \underbrace{0000}_{\substack{\uparrow \\ E}} \Rightarrow 10,00000 \times 2^{0000} = -(0 \times 2^0) = -0 \times 1 = -0 \quad \Leftarrow$$

$$\underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{00001}_{\substack{\uparrow \\ M}} \underbrace{1111}_{\substack{\uparrow \\ E}} \Rightarrow 0\,0,00001 \times 2^{1111} = +(2^{-5} \times 2^{-7}) = +2^{-12} \quad \Leftarrow$$

$$2) \, M \begin{cases} \text{fraccionaria} \\ \text{BCS 5 bits} \end{cases} \quad E \begin{cases} \text{BSS} \\ 3 \text{ bits} \end{cases}$$

a) Sin normalizar

$$\underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{1000}_{\substack{\uparrow \\ M}} \underbrace{111}_{\substack{\uparrow \\ E}} \Rightarrow 0\,0,1000 \times 2^{111} = +(2^{-1}) \times 2^7 = +(2^6) = 64 \quad \Leftarrow$$

Normalizada

$$\underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{1000}_{\substack{\uparrow \\ M}} \underbrace{111}_{\substack{\uparrow \\ E}} \Rightarrow 0\,0,1000 \times 2^{111} = +(2^{-1}) \times 2^7 = +(2^6) = 64 \quad \Leftarrow$$

Con bit implícito

$$\begin{aligned} \underbrace{0}_{\substack{\uparrow \\ S}} \underbrace{1000}_{\substack{\uparrow \\ M}} \underbrace{111}_{\substack{\uparrow \\ E}} &\Rightarrow 0\,0,11000 \times 2^{111} = +(2^{-1} + 2^{-2}) \times 2^7 = \\ &= +(2^6 + 2^5) = 64 + 32 = 96 \quad \Leftarrow \end{aligned}$$

b) Sin normalizar

$$\underbrace{1}_{\substack{\downarrow \\ S}} \underbrace{1000}_{\substack{\downarrow \\ M}} \underbrace{011}_{\substack{\downarrow \\ E}} \Rightarrow 10,1000 \times 2^{011} = -(2^{-1}) \times 2^3 = -(2^2) = -4 \quad \Leftarrow$$

Normalizada

$$\underbrace{1}_{\substack{\downarrow \\ S}} \underbrace{1000}_{\substack{\downarrow \\ M}} \underbrace{011}_{\substack{\downarrow \\ E}} \Rightarrow 10,1000 \times 2^{011} = -(2^{-1}) \times 2^3 = -(2^2) = -4 \quad \Leftarrow$$

Con bit implícito

$$\underbrace{1}_{\substack{\downarrow \\ S}} \underbrace{1000}_{\substack{\downarrow \\ M}} \underbrace{011}_{\substack{\downarrow \\ E}} \Rightarrow 10,11000 \times 2^{011} = -(2^{-1} + 2^{-2}) \times 2^3 =$$

$$= -(2^2 + 2^1) = -(4 + 2) = -6 \quad \Leftarrow$$

c) Sin normalizar

$$\underbrace{0}_{\substack{\downarrow \\ S}} \underbrace{0000}_{\substack{\downarrow \\ M}} \underbrace{000}_{\substack{\downarrow \\ E}} \Rightarrow 00,0000 \times 2^{000} = +0 \quad \Leftarrow$$

Normalizada

No se puede. La mantisa no empieza con 0,1...

Con bit implícito

$$\underbrace{0}_{\substack{\downarrow \\ S}} \underbrace{0000}_{\substack{\downarrow \\ M}} \underbrace{000}_{\substack{\downarrow \\ E}} \Rightarrow 00,10000 \times 2^{000} = +(2^{-1}) \times 2^0 =$$

$$= +(2^{-1}) \times 1 = +0,5 \quad \Leftarrow$$

d) Sin normalizar

$$\underbrace{1}_{\text{S}} \underbrace{1111}_{\text{M}} \underbrace{111}_{\text{E}} \Rightarrow 10,1111 \times 2^{11} = -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4}) \times 2^7 =$$

$$= -(2^6 + 2^5 + 2^4 + 2^3) = -(64 + 32 + 16 + 8) = -120 \quad \Leftarrow$$

Normalizada

$$\underbrace{1}_{\text{S}} \underbrace{1111}_{\text{M}} \underbrace{111}_{\text{E}} \Rightarrow 10,1111 \times 2^{11} = -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4}) \times 2^7 =$$

$$= -(2^6 + 2^5 + 2^4 + 2^3) = -(64 + 32 + 16 + 8) = -120 \quad \Leftarrow$$

Con bit implícito

$$\underbrace{1}_{\text{S}} \underbrace{1111}_{\text{M}} \underbrace{111}_{\text{E}} \Rightarrow 10,1111 \times 2^{11} = -(2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 2^{-5}) \times 2^7 =$$

$$= -(2^6 + 2^5 + 2^4 + 2^3 + 2^2) = -(64 + 32 + 16 + 8 + 4) = -124 \quad \Leftarrow$$
