

# Representations

Goodness of representation in  $m$ . in  $mm$

$$m, \mathbb{Z} \quad \left[ \begin{array}{c} x \\ s \end{array} \right]_s \quad |m| < 1 \quad \left[ \begin{array}{c} s \\ x \end{array} \right]_x$$

$$x \geq 0 \quad [x]_b = [x]_j = [x]_c = \left[ \begin{array}{c} s \\ |x| \end{array} \right]$$

$$x < 0 \quad [x]_b = \left[ \begin{array}{c} 1 \\ |x| \end{array} \right]$$

$$[x]_c = \left[ \begin{array}{c} 1 \\ |x| \end{array} \right] + 1 \text{ (if } x < 0 \text{)}$$

$m =$

$$x = 772_{(10)} = 7000_{(10)}$$

$$[x]_b = [0000000000000000]$$

$$[x]_j = [0000000000000000]$$

$$[x]_c = [0000000000000000]$$

$$m = 16$$

$$y = -238_{(10)} = -11101110_{(2)}$$

$$[y]_b = [1000000000000000]$$

$$[y]_j = [11111100010001]$$

$$[y]_c = [11111100010010]$$

$$m = 8$$

$$z = -0,78_{(10)} = -0,1100011_{(2)}$$

$$[z]_b = [11100011]$$

$$[z]_j = [110011100]$$

$$[z]_c = [110011101]$$

$$m = 8$$

$$t = 0,53_{(10)} = 0,1000011_{(2)}$$

$$[t]_b = [01000011] = [t]_j = [t]_c$$

$$\begin{array}{r} 772 \\ 97 \\ 35 \\ 72 \\ 8 \\ 1 \\ 2 \\ 7 \end{array} \begin{array}{r} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array} \begin{array}{r} 0 \\ 7 \\ 7 \\ 7 \\ 0 \\ 0 \\ 0 \\ 7 \end{array}$$

$$\begin{array}{r} 238 \\ 119 \\ 59 \\ 29 \\ 14 \\ 7 \\ 3 \\ 1 \end{array} \begin{array}{r} 2 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{array} \begin{array}{r} 0 \\ 1 \\ 1 \\ 1 \\ 0 \\ 1 \\ 1 \\ 1 \end{array}$$

$$\begin{array}{r} 0,32 \\ 1,34 \\ 0,24 \\ 0,96 \\ 1,12 \\ 1,18 \\ 1,92 \end{array} \begin{array}{r} 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \\ 2 \end{array} \begin{array}{r} 0,12 \\ 0,12 \\ 0,24 \\ 0,56 \\ 1,12 \\ 1,26 \\ 1,56 \end{array}$$

$$\begin{array}{l} 0,53 \cdot 2 = 1,06 \\ 0,06 \cdot 2 = 0,12 \\ 0,12 \cdot 2 = 0,24 \\ 0,24 \cdot 2 = 0,48 \\ 0,48 \cdot 2 = 0,96 \\ 0,96 \cdot 2 = 1,92 \\ 0,92 \cdot 2 = 1,84 \end{array}$$

Operații pe cod complement

$$\begin{array}{r} \Delta_1 \quad | \quad \oplus \\ \Delta_2 \quad | \quad \oplus \\ \hline \Delta_3 \quad | \quad \oplus \end{array}$$

CF?

$$[x]_c \oplus [y]_c = \begin{array}{cccccc} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ \hline 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{array}$$

(nu avem depășire)

Dacă  $(\Delta_1 = \Delta_2) \neq \Delta_3$  avem depășire

$$[x]_c \ominus [y]_c = [x]_c \oplus [-y]_c$$

$$[z]_c \oplus [t]_c =$$

$$= \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ \hline 1 & 1 & 0 & 1 \end{array} \oplus \begin{array}{cccc} 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ \hline 1 & 1 & 1 & 1 \end{array}$$

(nu avem depășire)

$$[x]_c \ominus [y]_c = [x]_c \oplus [-y]_c =$$

$$= \begin{array}{cccc} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ \hline 0 & 0 & 0 & 0 \end{array} \oplus \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ \hline 0 & 0 & 0 & 0 \end{array}$$

(nu avem depășire)

$$[z]_c \ominus [x]_c = [z]_c \oplus [-x]_c =$$

$$\begin{array}{cccc} 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ \hline 1 & 0 & 1 & 1 \end{array}$$

CF=1  
OF=1

Depășire

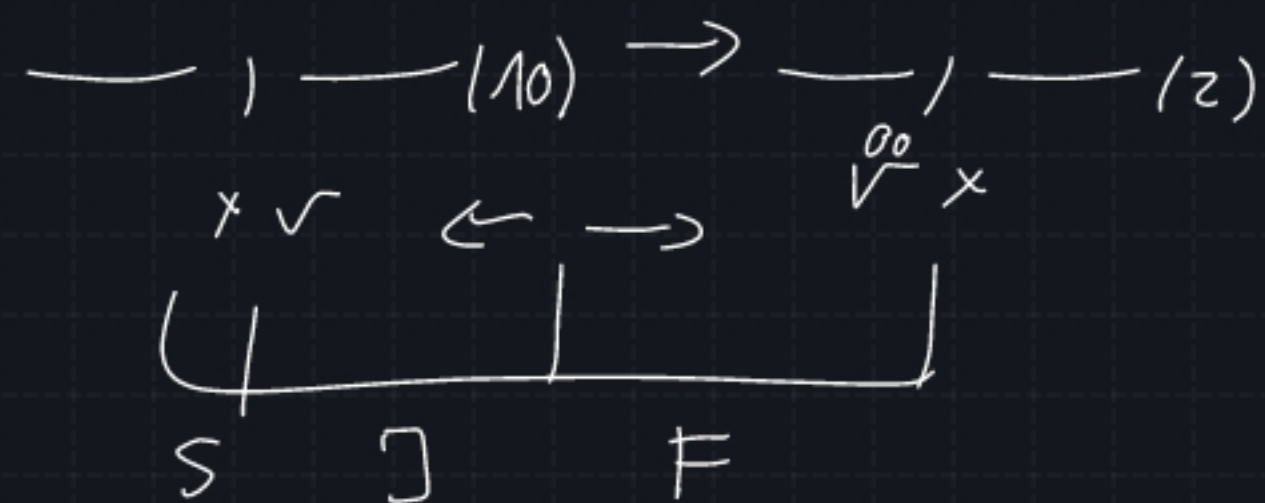
$$[t]_c \ominus [z]_c = [t]_c \oplus [-z]_c$$

$$= \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ \hline 1 & 0 & 1 & 0 \end{array} \oplus \begin{array}{cccc} 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ \hline 1 & 0 & 1 & 0 \end{array}$$

Depășire



# Reprezentarea în virgulă fixă



$$m = 16$$

$$X = 5426,403_{(10)} = 12462,316_{(8)} = \underline{001010102110010,011001110}_{(2)}$$

$$5426 : 8 = 678 \text{ r } 2$$

$$\begin{array}{r} 68 \\ 62 \\ 56 \\ 50 \\ 44 \\ 38 \\ 32 \end{array}$$

$$678 : 8 = 84 \text{ r } 6$$

$$80 + 4 \text{ r } 4 : 8 = 10 \text{ r } 4$$

$$10 : 8 = 1 \text{ r } 2$$

$$1 : 8 = 0 \text{ r } 1$$

$$0,403 \times 8 = 3,224$$

$$\begin{array}{r} 403 \times \\ 8 \\ 24 \\ 32 \\ 3224 \end{array}$$

$$0,224 \times 8 = 1,792$$

$$\begin{array}{r} 224 \times \\ 8 \\ 32 \\ 16 \\ 1792 \end{array}$$

$$0,792 \times 8 = 6,336$$

$$\begin{array}{r} 792 \times \\ 8 \\ 16 \\ 72 \\ 6336 \end{array}$$

$$\underline{012110010,01100111}$$

$$\begin{array}{r} 0 \\ 1 \\ 1 \\ 1 \\ 0 \end{array} \bigg| \begin{array}{r} 75 \\ 50 \\ 00 \end{array} : 2$$

$$X = -12,75_{(10)} = -1100,11_{(2)}$$

$$\underline{110001100110000001}$$

Reprezentarea în virgulă mobilă, simplă precizie

$$-1 - (10) = -1 - (2) \begin{cases} \text{mantină normalizată} \\ 0, 1 \dots (2) \cdot 2^E \\ \text{mantină supraunitară (între 1 și 2)} \\ 1, \dots (2) \cdot 2^{E'} \end{cases} \rightarrow M$$

$$\begin{array}{|c|c|c|} \hline 5 & 8C & 23M \\ \hline \end{array} \quad 32\text{ bits}$$

$$C = Q + E$$

$$127 = 2^7 - 1$$

mantină normalizată

$$X = 5426,403_{(10)} = 12462,316_{(8)} = 1010100110010,011001110_{(2)} =$$

$$= 0,4010100110010011001110_{(2)} \cdot 2^{13} \quad E = +13$$

$$C = Q + E = 2^7 - 1 + 13 = 2^7 + 12 = 10000000_{(2)} +$$

$$\begin{array}{r} 1100_{(2)} \\ 10001100_{(2)} \end{array}$$

$$101000110010101001100100110011100$$

$$\begin{array}{r} 24 \\ 0,336_{(10)} \\ \hline 2,688 \end{array}$$

mantină supraunitară

$$Y = 1275_{(10)} = -1100,11_{(2)} = -1,10011_{(2)} \cdot 2^3$$

$$E \Rightarrow C = Q + E = 2^7 - 1 + 3 = 2^7 + 2 = 10000010_{(2)}$$

$$11100000101001100000000000000000$$

$$Z = \frac{5}{16^2} = 5 \times 16^{-2} = 0,05_{(16)} = 0,00000101_{(2)} = 1,01_{(2)} \cdot 2^{-5}$$

• mantină supraunitară

$$E = -6 \Rightarrow C = (2^7 - 1) - 6 = 111111_{(2)} -$$

$$\begin{array}{r} 0110_{(2)} \\ 1111001_{(2)} \end{array}$$

$$\begin{array}{|c|c|c|} \hline 5 & 8C & 23M \\ \hline \end{array} \quad 32\text{ bits}$$