

# Exercícios Capítulo 1 - Métodos Numéricos

1) base: 10  
 $t = 6 \Rightarrow F(10, 6, -99, 99)$   
 $e_1 = -99$   
 $e_2 = 99$

a)  $\pm \_, \_ \_ \_ \_ \_$

$2 \times 9 \times 10^5 = \underline{18 \times 10^5}$

b)  $99 - (-99) + 1 = \underline{199}$

c)  $18 \times 10^5 \times 199 + 1 = \underline{3582 \times 10^5 + 1}$

d)  $9,99999 \times 10^{99}$

e)  $1,00000 \times 10^{-99}$

f) Maior:  $0,00001 \times 10^{99} = 10^{-5} \times 10^{99} = \underline{10^{94}}$

Menor:  $0,00001 \times 10^{-99} = 10^{-5} \times 10^{-99} = \underline{10^{-104}}$

g) overflow:  $(-\infty; -9,99999 \times 10^{99}) \cup (9,99999 \times 10^{99}; \infty)$

underflow:  $(-1,00000 \times 10^{-99}; 0) \cup (0; 1,00000 \times 10^{-99})$

h)  $527,4665 \times 10^{-3}$

$\Downarrow$   
 $5,27466 \times 10^{-1}$

i) Adição:  $9,99999 \times 10^{99} + \frac{1,00000}{0,00001} \times 10^{99} \Rightarrow \text{overflow}$

Subtração:  $-9,99999 \times 10^{99} - \frac{1,00000}{0,00001} \times 10^{99} \Rightarrow \text{overflow}$

Multiplicação:  $1,00000 \times 10^{-99} \times 1,00000 \times 10^{-99} \Rightarrow \text{underflow}$

$$2) f(2,5, -3,3)$$

$$a) \pm \_, \_ \_ \_ \_$$

$$2 \times 1 \times 2^4 = 2^5 = 32$$

$$b) 3 - (-3) + 1 = 7$$

$$c) 32 \times 7 \div 1 = 225$$

$$d) 1,1111 \times 2^3 = 1111,1_2$$

$$= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1}$$

$$= 15,5$$

$$e) 1,0000 \times 2^{-3} = 0,001_2$$

$$= 0 \times 2^{-1} + 0 \times 2^{-2} + \frac{1}{8} \times 2^{-3}$$

$$= \frac{1}{8} = 0,125$$

$$f) \text{ maior: } 0,0001 \times 2^3 = 0,1_2 = 0,5_{10}$$

$$\text{menor: } 0,0001 \times 2^{-3} = 0,000001_2 = 1 \times 2^{-7} = 0,0078125_{10}$$

$$g) \text{ overflow: } (-\infty, -15,5) \cup (15,5; \infty)$$

$$\text{under flow: } (-0,125; 0) \cup (0; 0,125)$$

$$h) 10,75_{10} =$$

$$\begin{array}{r} 10 \overline{) 1075} \\ 0 \quad 5 \overline{) 1075} \\ \quad 1 \quad 2 \overline{) 1075} \\ \quad \quad 0 \quad 1 \end{array} \Rightarrow 1010 \quad \left| \quad \begin{array}{l} 0,75 \times 2 = 1,50 \\ 0,50 \times 2 = 1,00 \\ \quad 11 \end{array} \right.$$

$$\text{Logo } 10,75_{10} = 1010,11_2 \Rightarrow 1,0101 \times 2^3 \Rightarrow \underline{1,0101 \times 2^{11}}$$

$$i) \text{ Adição: } 1,1111 \times 2^{11} + 1,0000 \times 2^{11} \Rightarrow \text{overflow}$$

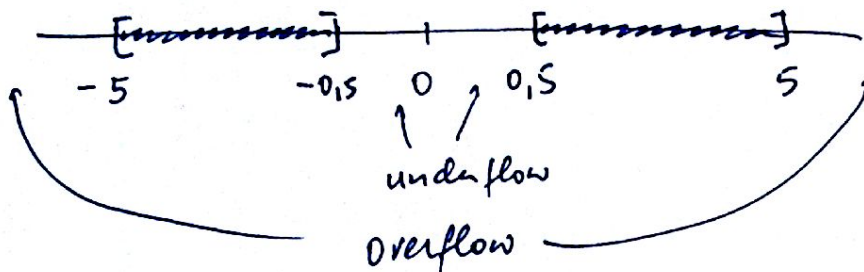
$$-1,1111 \times 2^{11} - 1,0000 \times 2^{11} \Rightarrow \text{overflow}$$

$$1,0000 \times 2^{11} \times 1,0000 \times 2^{11} \Rightarrow \text{under flow}$$

$$3) f(2, 3, -1, 2)$$

$$X_{\max} = 1,11 \times 2^2 = 1,11_2 = 5_{10}$$

$$X_{\min} = 1,00 \times 2^{-1} = 0,10_2 = 0,5_{10}$$



$$4) f(b, 2, -2, 5)$$

37 de ventos?

$$N = 2 \times (b-1) \cdot b^{t-1} \cdot (e_2 - e_1 + 1) + 1$$

$$37 = 2 \times (b-1) \cdot b^1 \cdot (5 - (-2) + 1) + 1$$

$$37 = 2 \times (b-1) \cdot b \cdot 8 + 1$$

$$36 = 16b^2 - 16b \div 4$$

$$9 = 4b^2 - 4b$$

$$4b^2 - 4b - 9 = 0$$

$$b = \frac{4 \pm \sqrt{16 - 4 \cdot 4 \cdot (-9)}}{8}$$

$$b = \frac{4 \pm \sqrt{160}}{8} \Rightarrow b' = \frac{4 + 12,65}{8}$$

$$b'' = \frac{4 - 12,65}{8}$$

$\Rightarrow$  Não existe sistema, pois  $b$  deveria ser  $\geq 2$ .

$$5) a) 10^{30} \times 10^{80} = 10^{110}$$

↳ não deu overflow

Caso o sistema fosse  $F(10, 9, -99, 99)$ , teríamos overflow

$$b) 10^{-40} \times 10^{-80} = 10^{-120}$$

$$c) 25^4 - 25^{-4} = 25^4$$

$$\begin{aligned} &= 390.625 - 2,56 \times 10^{-6} = \\ &= 3,90625 \times 10^5 - 2,56 \times 10^{-6} = \\ &= 3,90625 \times 10^5 - 0,00000000000256 \times 10^5 = \\ &= \underline{3,90625 \times 10^5} \end{aligned}$$

$$6) F(10, 5, -9, 9) \quad a = 32,424$$

$$b = 4,2131$$

$$c = 0,000382 = 3,82 \times 10^{-4}$$

$$(a+b) + c = a + (b+c)$$

$$\begin{aligned} a+b &= \cancel{3,2424 \times 10^1} + \cancel{0,4213} \\ &= 32,424 \times 10^0 + 4,2131 \times 10^0 \\ &= \cancel{3,2424 \times 10} \\ &= 36,6371 \times 10^0 = 3,6637 \times 10^1 \end{aligned}$$

$$\begin{aligned} (a+b) + c &= 3,6637 \times 10^1 + 3,82 \times 10^{-4} \\ &= 366370 \times 10^{-4} + 3,82 \times 10^{-4} = 366373,82 \times 10^{-4} \\ &= \underline{3,6637 \times 10^1} \end{aligned}$$

$$b+c = 4,2131 \times 10^0 + 3,82 \times 10^{-4}$$

$$= 42131 \times 10^{-4} + 3,82 \times 10^{-4} = 42134,82 \times 10^{-4} = 4,213482 \times 10^0$$

$$\begin{aligned} (b+c) + a &= 32,424 \times 10^0 + 4,213482 \times 10^0 = 36,637482 \times 10^0 \\ &= \underline{36,6375 \times 10^0} \end{aligned}$$

Resposta:

São diferentes.  
Problemas na associatividade.

(4)

$$7) f(10, 5, -99, 99)$$

$$S = \sum_{n=0}^4 \frac{1}{7^n}$$

$$a) \frac{1}{7^0} + \frac{1}{7^1} + \frac{1}{7^2} + \frac{1}{7^3} + \frac{1}{7^4}$$

$$\begin{aligned} & 1,0000 \times 10^0 \\ + & 1,4286 \times 10^{-1} = 1,1429 \times 10^0 \\ + & 2,0408 \times 10^{-2} = 1,1633 \times 10^0 \\ + & 2,9154 \times 10^{-3} = 1,1662 \times 10^0 \\ + & 4,1649 \times 10^{-4} = \underline{1,1666 \times 10^0} \end{aligned}$$

b) invertido

$$\begin{aligned} & 4,1649 \times 10^{-4} (0,4165 \times 10^{-3}) \\ + & 2,9154 \times 10^{-3} = 3,3319 \times 10^{-3} (0,3332 \times 10^{-2}) \\ + & 2,0408 \times 10^{-2} = 2,3740 \times 10^{-2} (0,2374 \times 10^{-1}) \\ + & 1,4286 \times 10^{-1} = 1,6660 \times 10^{-1} (0,1666 \times 10^0) \\ + & 1,0000 \times 10^0 = \underline{1,666 \times 10^0} \end{aligned}$$

c) Os resultados são iguais.

$$8) f(10, 5, -99, 99)$$

$$S = \sum_{n=1}^5 \frac{1}{i^n}$$

$$a) \frac{1}{1} + \frac{1}{2^2} + \frac{1}{3^3} + \frac{1}{4^4} + \frac{1}{5^5}$$

$$\begin{aligned} & 1,0000 \times 10^0 \\ & + 2,5000 \times 10^{-1} \text{ (0,2500} \times 10^0 \text{)} = 1,2500 \times 10^0 \\ & + \cancel{4,4444 \times 10^{-1}} \\ & + 3,7037 \times 10^{-2} \text{ (0,0370} \times 10^0 \text{)} = 1,2870 \times 10^0 \\ & + 3,9062 \times 10^{-3} \text{ (0,0039} \times 10^0 \text{)} = 1,2909 \times 10^0 \\ & + 3,2000 \times 10^{-4} \text{ (0,0003} \times 10^0 \text{)} = \underline{1,2912 \times 10^0} \end{aligned}$$

SOMA  
↓

b) invertido

$$\begin{aligned} & 3,2000 \times 10^{-4} \text{ (0,3200} \times 10^{-3} \text{)} \\ & + 3,9062 \times 10^{-3} = 4,2262 \times 10^{-3} \text{ (0,4226} \times 10^{-2} \text{)} \\ & + 3,7037 \times 10^{-2} = 4,1263 \times 10^{-2} \text{ (0,4126} \times 10^{-1} \text{)} \\ & + 2,5000 \times 10^{-1} = 2,9126 \times 10^{-1} \text{ (0,2913} \times 10^0 \text{)} \\ & + 1,0000 \times 10^0 = \underline{1,2913 \times 10^0} \end{aligned}$$

c) o resultado correto é 1,291263...

⇒ falta na associatividade da adição.

O resultado é melhor, pois é a ~~gr~~ arredondamento correto de 1,291263... ≈ 1,2913

9) não fig. similar a 8.

10)  $t=3$

$$e_1 = e_2 = 0$$

Sim, podemos ter overflow.

$$5,00 \times 10^0 + 5,00 \times 10^0 \Rightarrow \text{overflow.}$$

$$5,10 \times 10^0 - 5,00 \times 10^0 \Rightarrow \text{underflow}$$

11)

a) Verdadeiro.

$$\text{O erro máximo } \bar{e} \leq \frac{1}{2} b^{(e_2 - t + 1)}$$

b) Verdadeiro, pois  $x+h=x$

c) Falso, representa um intervalo de reais.

d) Verdadeiro. Ver exercícios 6, 8 e 9.

e)  $F(10, 6, -99, 99)$

$$x = 0,4721025 \times 10^8 \Rightarrow 4,72102 \times 10^7$$

$$y = 1,00321 \times 10^5$$

$$z = 0,0072134 \times 10^6 \Rightarrow 0,072134 \times 10^5$$

$$y+z = 1,07534 \times 10^5$$

$$x \times (y+z) = \frac{5,07670 \times 10^{12}}{}$$

$$x \times y = 4,73617 \times 10^{12}$$

$$x \times z = 0,34054605 \times 10^{12} = 0,34055 \times 10^{12}$$

$$x \times y + x \times z = \underline{5,07672 \times 10^{12}}$$

Falso!

(7)

11) cont.

$$f) f(10, 3, -90, 90) \Rightarrow u(F_A) = 2 \times 9 \times 10^2 \times 181 + 1$$

$$F_B(10, 4, -9, 9) \Rightarrow u(F_B) = 2 \times 9 \times 10^3 \times 19 + 1$$

False

$$g) F_B(10, 4, -9, 9)$$

$$x = 73 = 7,300 \times 10^1$$

$$x^{-1} = \frac{1}{x} = 1,000 \times 10^0 \div 7,300 \times 10^1 \\ = 0,137 \times 10^{-1}$$

$$(x^{-1})^{-1} = 1,000 \times 10^0 \div 0,137 \times 10^{-1} \\ = 7,299 \times 10^1 \neq 73$$

False.

12) false.

13)