ELE075 - Sistemas Nebulosos - 2018/2

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Lista de Exercícios

① a) $\mu_{\bar{A}} = 1 - \mu_A \Rightarrow \mu_{\bar{\bar{A}}} = 1 - (1 - \mu_A) = 1 - 1 + \mu_A \therefore \mu_{\bar{\bar{A}}} = \mu_A$

b) $\max(\mu_A, \min(\mu_A, \mu_B)) = \mu_A$
já que $\min(\mu_A, \mu_B) \leq \mu_A$

c) $\min(\mu_A, 1 - \mu_A) = \mu_\emptyset = 0$
$\mu_A : X \rightarrow \{0; 1\}$
Se $\mu_A = 0 \rightarrow \min(0, 1 - 0) = 0$
Se $\mu_A = 1 \rightarrow \min(1, 1 - 1) = 0$

d) $1 - \max(\mu_A, \mu_B) = \min(1 - \mu_A, 1 - \mu_B)$
$\mu_A, \mu_B : X \rightarrow \{0; 1\}$
Se $\mu_A = 1 \rightarrow \max(1, \mu_B) = 1$ e $\min(0, 1 - \mu_B) = 0$
$\rightarrow 1 - 1 = 0$
Se $\mu_A = 0 \rightarrow \max(0, \mu_B) = \mu_B$ e $\min(1, 1 - \mu_B) = 1 - \mu_B$
$\rightarrow 1 - \mu_B = 1 - \mu_B$

② a) $\bar{\bar{A}} = (\bar{\bar{A}}) = A$

A Lista continua no verso →

b) $A \cup (A \cap B) = (A \cup A) \cap (A \cup B) = A \cap (A \cup B) = A$

c) $A \cap \bar{A} = \overline{\bar{A} \cup A} = \overline{X} = 0$
↳ universo

d) Se $\overline{A \cup B} = \bar{A} \cap \bar{B}$ então:
① $(A \cup B) \cup (\bar{A} \cap \bar{B}) = X$
② $(A \cup B) \cap (\bar{A} \cap \bar{B}) = \emptyset$

① $(A \cup B) \cup (\bar{A} \cap \bar{B}) = (A \cup B \cup \bar{A}) \cap (A \cup B \cup \bar{B})$
$= (X \cup B) \cap (X \cup A) = X \cap X = X$

② $(A \cup B) \cap (\bar{A} \cap \bar{B}) = (\bar{A} \cap \bar{B} \cap A) \cup (\bar{A} \cap \bar{B} \cap B)$
$= (\emptyset \cap \bar{B}) \cup (\emptyset \cap \bar{A}) = \emptyset$

(3) n1: $N(0) = \frac{1-0}{1-50} = \frac{1}{1} = 1$ e $N(1) = \frac{1-1}{1-5} = \frac{0}{1-5} = 0$

n2: $a=0$, $b=0,5$, $s=-1$
$N(a) = N(0) = 1 \geq N(b) = \frac{1-0,5}{1+0,5} = \frac{0,5}{1,5} = \frac{1}{3}$

n4: $a=0,5$, $s=-1$
$N(a) = N(0,5) = \frac{1}{3} \Rightarrow N(\frac{1}{3}) = \frac{1-1/3}{1+1/3} = \frac{2/3}{4/3} = \frac{1}{2} = 0,5$

(4) s1: $S(0,0) = 0+0-0 \cdot 0 = 0$
$S(0,a) = 0+a-0 \cdot a = a$

s2: $a=0$, $b=0,8$, $c=0,2$, $d=1$
$S(0, 0,8) = 0+0,8-0 \cdot 0,8 = 0,8 \leq S(0,2, 1) = 0,2+1-0,2 \cdot 1 = 1$

s3: $a=0,2$, $b=0,8$
$S(0,2, 0,8) = 0,2+0,8-0,2 \cdot 0,8 = 0,84 = S(0,8, 0,2) = 0,8+0,2+0,8 \cdot 0,2$ (= 0,84)

s4: $a=0$, $b=0,5$, $c=1$, $S(a,b) = 0,5$, $S(b,c) = 1$
$S(a, S(b,c)) = 0+1-0 \cdot 1 = 1 = S(S(a,b), c) = 0,5+1-0,5 \cdot 1 = 1$

Continua ao lado →

$(1-a)(1-b) = 1-b-a+ab$

⑤ t1: $T(0,0) = 0 \cdot 0 = 0$, $T(a,1) = T(1,a) = 1 \cdot a = a$

t2: $a=0, b=0,8, c=0,2, d=1$

$T(a,b) = 0 \cdot 0,8 = 0 \leq T(c,d) = 0,2 \cdot 1 = 0,2$

t3: $a = 0,2$, $b = 0,8$

$T(a,b) = 0,2 \cdot 0,8 = 0,16 = T(b,a) = 0,8 \cdot 0,2 = 0,16$

t4: $a=0, b=0,5$, $c=1$, $T(a,b)=0$, $T(b,c)=0,5$

$T(a, T(b,c)) = 0 \cdot 0,5 = 0 = T(T(a,b), c) = 0 \cdot 1 = 0$

⑥ $N(S(N(a), N(b))) = N(S(1-a, 1-b)) = N((1-a)+(1-b) -$
$-(1-a)(1-b)) = N(1-a+1-b-1+a+b-ab) = N(1-ab) =$
$= 1-(1-ab) = ab = T(a,b)$

$N(P(N(a), N(b))) = N(P(1-a, 1-b)) = N((1-a)(1-b)) =$
$= N(1-b-a+ab) = 1-(1-b-a+ab) = a+b-ab = S(a,b)$

⑦

$$A = \begin{pmatrix} 1 & 0,5 & 0,4 & 0,2 \end{pmatrix} \quad R = \begin{pmatrix} 1 & 0,8 & 0 & 0 \\ 0,8 & 1 & 0,8 & 0 \\ 0 & 0,8 & 1 & 0,8 \\ 0 & 0 & 0,8 & 1 \end{pmatrix}$$

$B = A \circ R \Rightarrow \begin{pmatrix} 1 & 0,8 & 0,5 & 0,4 \end{pmatrix}$

A lista continua no verso →

(10) Se x é A_1 então y é B_1
Se x é A_2 então y é B_2
Fato: $\mu_{A'}(x) = 0/x_1 + 1/x_2 + 0/x_3$

$\mu_{R1}(x,y) = \mu_{A1}(x) \wedge \mu_{B1}(y)$
$\mu_{R2}(x,y) = \mu_{A2}(x) \wedge \mu_{B2}(y)$

$\mu_{R1}(x,y)$	y_1	y_2
x_1	0,1	0,2
x_2	0,1	0,3
x_3	0,1	0,3

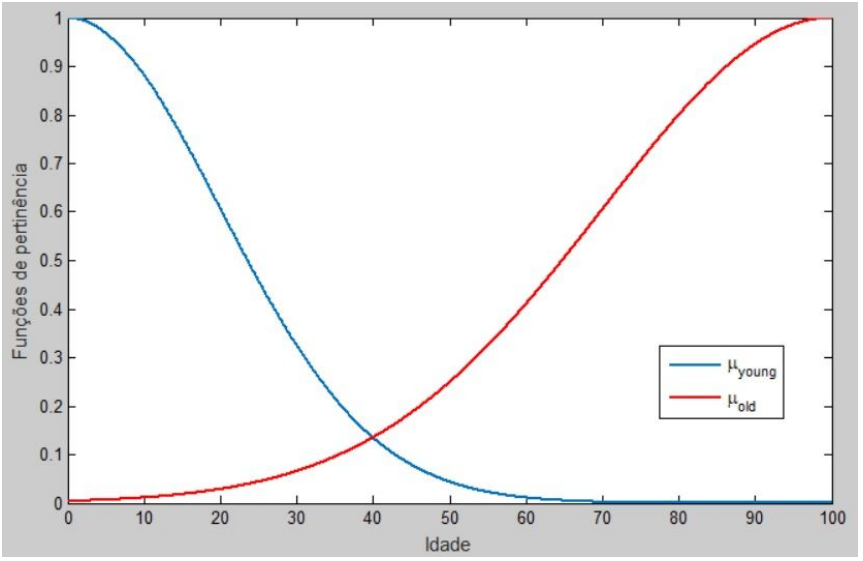
$\mu_{R2}(x,y)$	y_1	y_2
x_1	0,6	0,2
x_2	0,6	0,2
x_3	0,3	0,2

$B' = (A' \circ R_1) \cup (A' \circ R_2)$
$\bigvee_y (\mu_{A'}(x) \wedge \mu_{R1}(x,y)) = \mu_{B1'}(y)$
$\bigvee_y (\mu_{A'}(x) \wedge \mu_{R2}(x,y)) = \mu_{B2'}(y)$

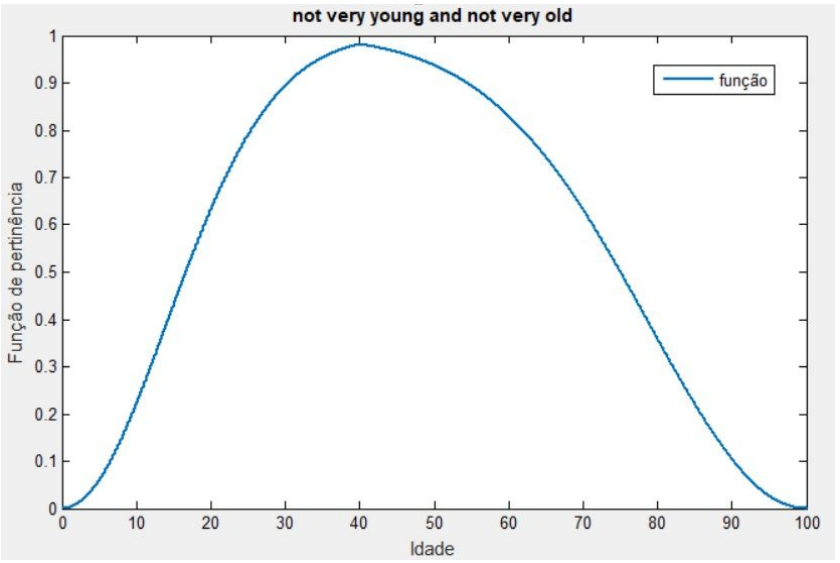
$\mu'_{B1}(y) = \bigvee x(0, 0.1, 0), \bigvee x(0, 0.3, 0) = 0,1/y_1 + 0,3/y_2$
$\mu'_{B2}(y) = \bigvee x(0, 0.6, 0), \bigvee x(0, 0.2, 0) = 0,6/y_1 + 0,2/y_2$

$\mu_{B'}(y) = \mu'_{B1}(y) \vee \mu'_{B2}(y) = (0,1/y_1 + 0,3/y_2) \vee (0,6/y_1 + 0,2/y_2)$
$\mu_{B'}(y) = 0,6/y_1 + 0,3/y_2$

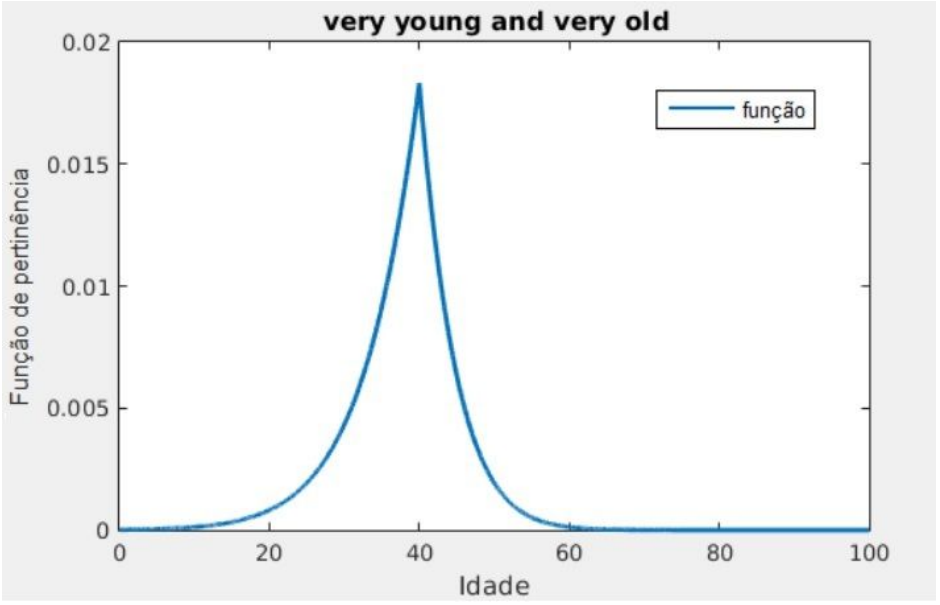
8)


Funções de pertinência
Idade
μyoung
μold

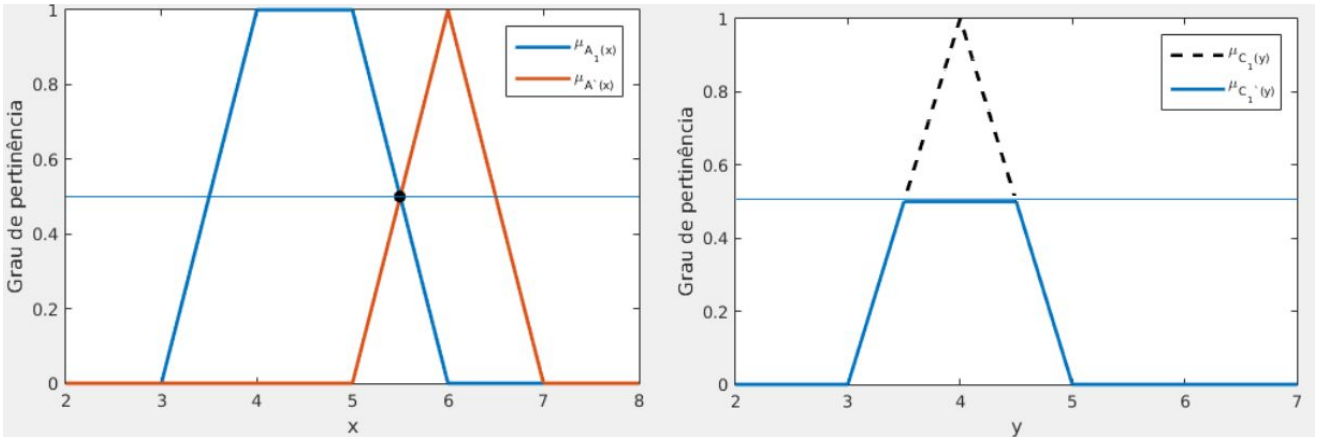
9) a -

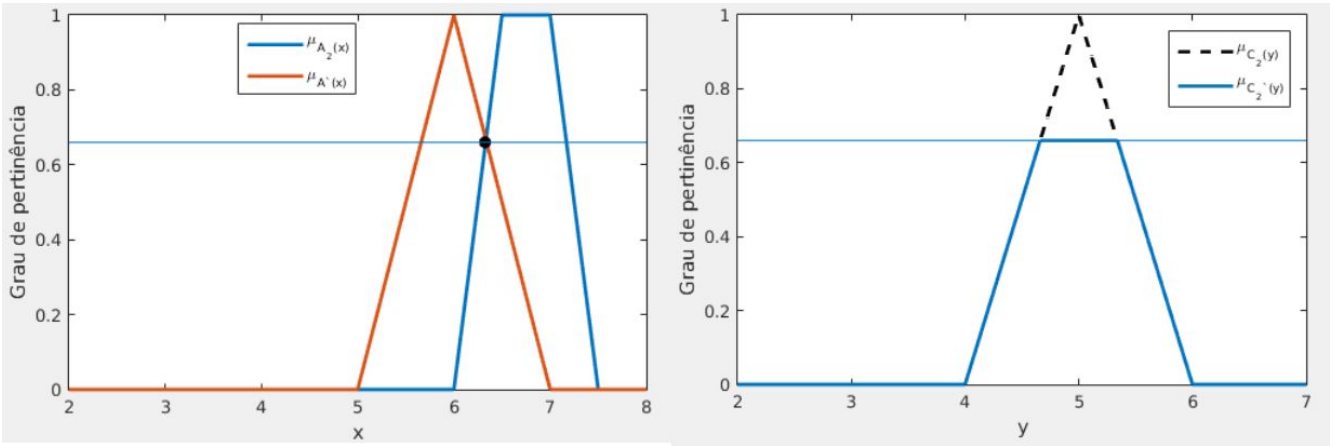

not very young and not very old
Função de pertinência
Idade
função

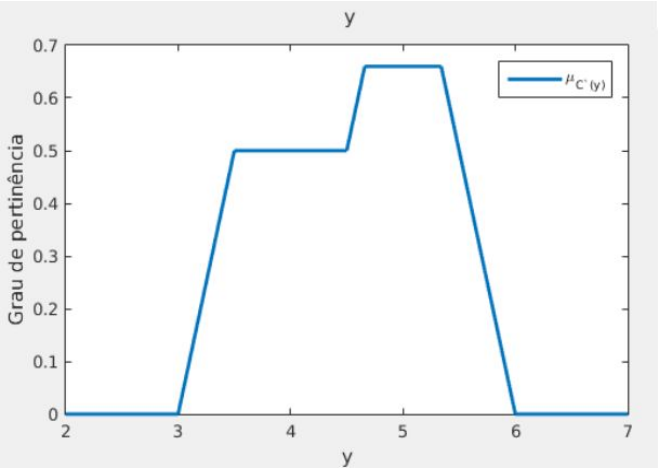
b -


very young and very old
Função de pertinência
Idade
função

11)


Grau de pertinência
x
y
$\mu_{A_1}(x)$
$\mu_{A'}(x)$
$\mu_{C_1}(y)$
$\mu_{C_1'}(y)$


Grau de pertinência
x
y
$\mu_{A_2}(x)$
$\mu_{A'}(x)$
$\mu_{C_2}(y)$
$\mu_{C_2'}(y)$


Grau de pertinência
y
$\mu_{C'}(y)$