

ELE075 - Sistemas Nebulosos - 2018/2

Professor: Cristiano Leite de Castro

Engenharia de Sistemas

Aluno: Rafael Carneiro de Castro

Matrícula: 2013030210

Lista de Exercícios

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

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

c) $\min(\mu_A, 1 - \mu_A) = \mu_0 = 0$

$\mu_A: X \rightarrow \{0; 1\}$

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 $\min(1, 1 - \mu_B) = 1 - \mu_B$
 $\rightarrow 1 - \mu_B = 1 - \mu_B$

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

A lista continua no verso \rightarrow

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

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

\hookrightarrow universo

d) Se $\overline{A \cup B} = \bar{A} \cap \bar{B}$ intão:

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

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

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

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

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

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

$$\textcircled{3} m1: N(0) = \frac{1-0}{1-50} = \frac{1}{1} = 1 \quad , \quad N(1) = \frac{1-1}{1-5} = \frac{0}{1-5} = 0$$

$$m2: a=0, b=0,5, s=-1$$

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

$$m4: a=0,5, s=-1$$

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

$$\textcircled{4} s1: S(0,0) = 0+0-0 \cdot 0 = 0$$

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

$$s2: a=0, b=0,8, c=0,2, d=1$$

$$S(0,0,8) = 0+0,8-0 \cdot 0,8 = 0,8 \leq S(0,2,1) = 0,2+1-0,2 \cdot 1 = 1$$

$$s3: a=0,2, b=0,8$$

$$S(0,2,0,8) = 0,2+0,8-0,2 \cdot 0,8 = 0,84 = S(0,8,0,2) = 0,8+0,2-0,8 \cdot 0,2$$

$$s4: a=0, b=0,5, c=1, S(a,b) = 0,5, S(b,c) = 1$$

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

continua ao lado \rightarrow

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

/ /

⑤ $t_1: T(0,0) = 0 \cdot 0 = 0$, $T(a,1) = T(1,a) = 1 \cdot a = a$

$t_2: a=0, b=0,8, c=0,2, d=1$

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

$t_3: a=0,2, b=0,8$

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

$t_4: a=0, b=0,5, c=1, T(a,b)=0, T(b,c)=0,5$

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

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

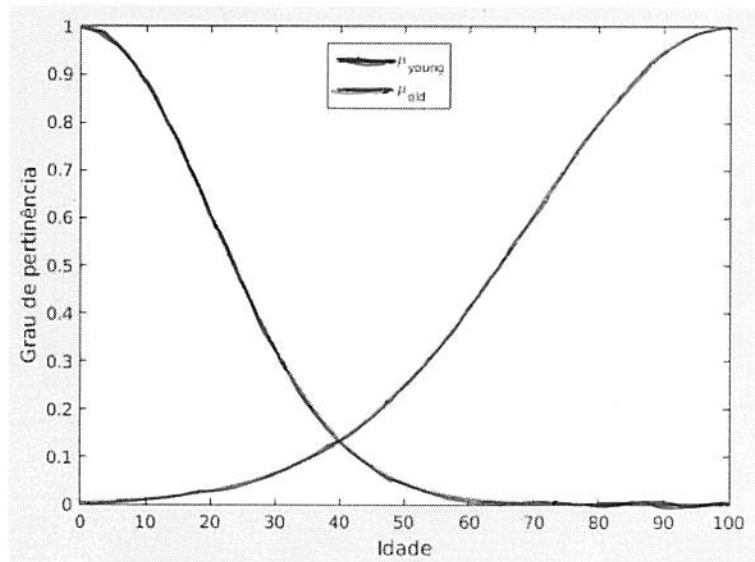
$N(P(N(a), N(b))) = N(P(1-a, 1-b)) = N((1-a)(1-b)) = N(1-b-a+ab) = 1 - (1-b-a+ab) = a+b-ab = S(a,b)$

⑦

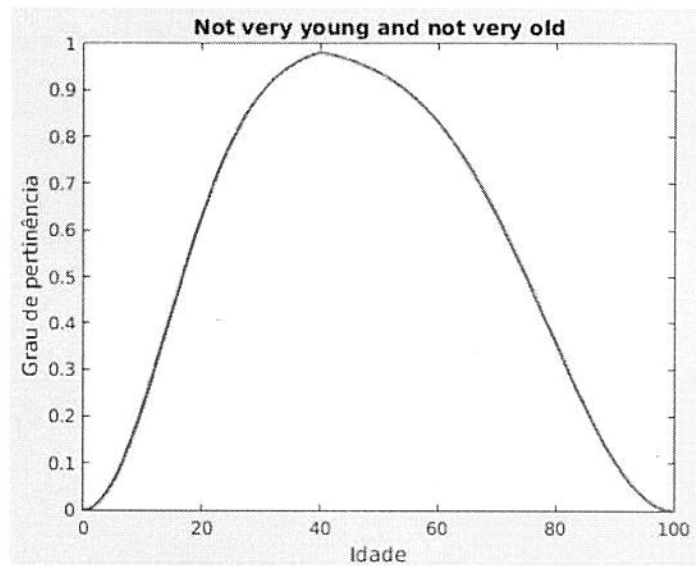
$$\begin{matrix} & A & & R \\ (1 & 0,5 & 0,4 & 0,2) & \circ \begin{pmatrix} 1 & 0,8 & 0 & 0 \\ 0,8 & 1 & 0,8 & 0 \\ 0 & 0,8 & 1 & 0,8 \\ 0 & 0 & 0,8 & 1 \end{pmatrix} \Rightarrow (1 & 0,8 & 0,5 & 0,4) \end{matrix} \quad B = A \circ R$$

A lista Continua no vídeo \rightarrow

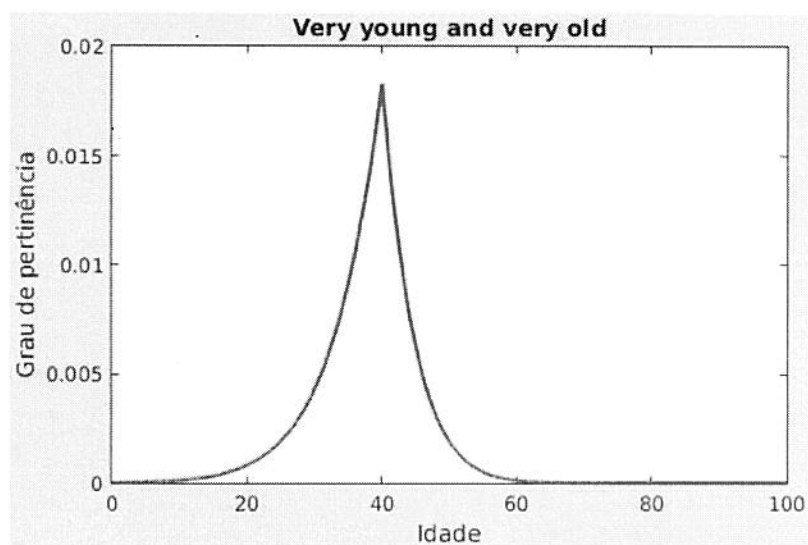
8)



9 a)



b)



10) Se $x \in A_1$ então $y \in B_1$

Se $x \in A_2$ então $y \in B_2$

Fato: $\mu_{A_1}(x) = 0/x_1 + 1/x_2 + 0/x_3$

$$\mu_{R_1}(x, y) = \mu_{A_1}(x) \wedge \mu_{B_1}(y)$$

$$\mu_{R_2}(x, y) = \mu_{A_2}(x) \wedge \mu_{B_2}(y)$$

| $\mu_{R_1}(x, y)$ | y_1 | y_2 | $\mu_{R_2}(x, y)$ | y_1 | y_2 |
|-------------------|-------|-------|-------------------|-------|-------|
| x_1 | 0,1 | 0,2 | x_1 | 0,6 | 0,2 |
| x_2 | 0,1 | 0,3 | x_2 | 0,6 | 0,2 |
| x_3 | 0,1 | 0,3 | x_3 | 0,3 | 0,2 |

$$B' = (A' \circ R_1) \cup (A' \circ R_2)$$

$$\forall y (\mu_{A'}(x) \wedge \mu_{R_1}(x, y)) = \mu_{B'_1}(y) \leftarrow$$

$$\forall y (\mu_{A'}(x) \wedge \mu_{R_2}(x, y)) = \mu_{B'_2}(y) \leftarrow$$

$$\mu_{B'_1}(y) = \forall x (0, 0.1, 0), \forall x (0, 0.3, 0) = 0.1/y_1 + 0.3/y_2$$

$$\mu_{B'_2}(y) = \forall x (0, 0.6, 0), \forall x (0, 0.2, 0) = 0.6/y_1 + 0.2/y_2$$

$$\mu_{B'}(y) = \mu_{B'_1}(y) \vee \mu_{B'_2}(y) = (0.1/y_1 + 0.3/y_2) \vee (0.6/y_1 + 0.2/y_2)$$

$$\mu_{B'}(y) = 0.6/y_1 + 0.3/y_2$$

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