Tutorial for

Introduction to Computational Intelligence in Winter 2009/10

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http://ls11-www.cs.tu-dortmund.de/people/rudolph/teaching/lectures/CI/WS2009-10/lecture.jsp

Sheet 7, Block B

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Return: 02.12.2009, 10 a.m.

Exercise 7.1: Fuzzy Implication (5 Points)

a) Use the increasing generator $g(x) = \sqrt{x}$ to derive a fuzzy implication. Does the resulting implication fulfill the axiom of contraposition?

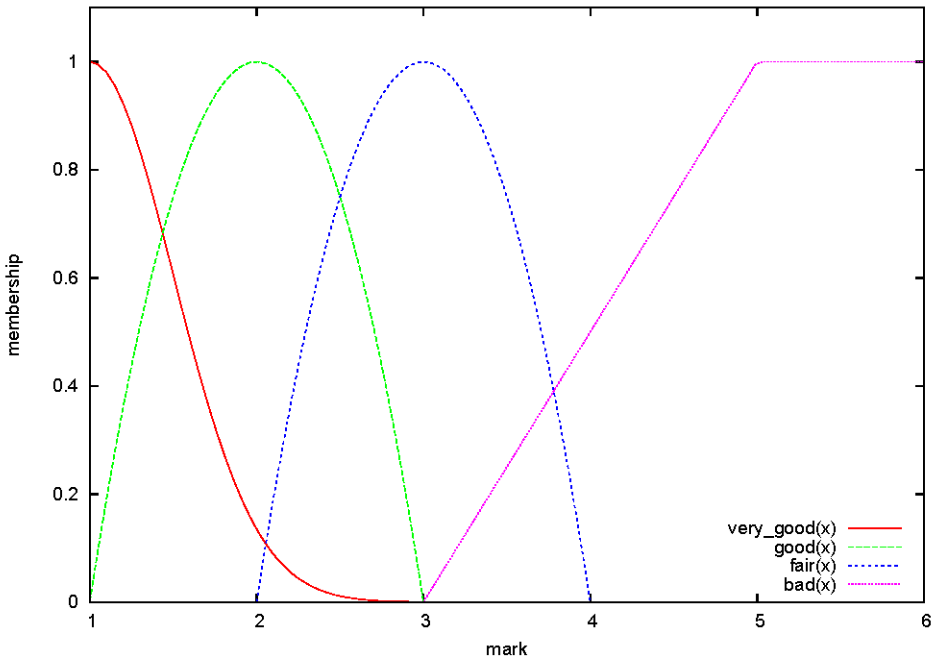
b) Check for all fuzzy implications below if they fulfill the axiom of contraposition:

- Reichenbach $\text{Imp}(a, b) = 1 - a + a\,b$
- Lukaciewicz $\text{Imp}(a, b) = \min\{1, 1 - a + b\}$
- Goguen $\text{Imp}(a, b) = 1_{[a \leq b]} + b \cdot 1_{[a > b]}$

Exercise 7.2: Fuzzy Inference (5 Points)

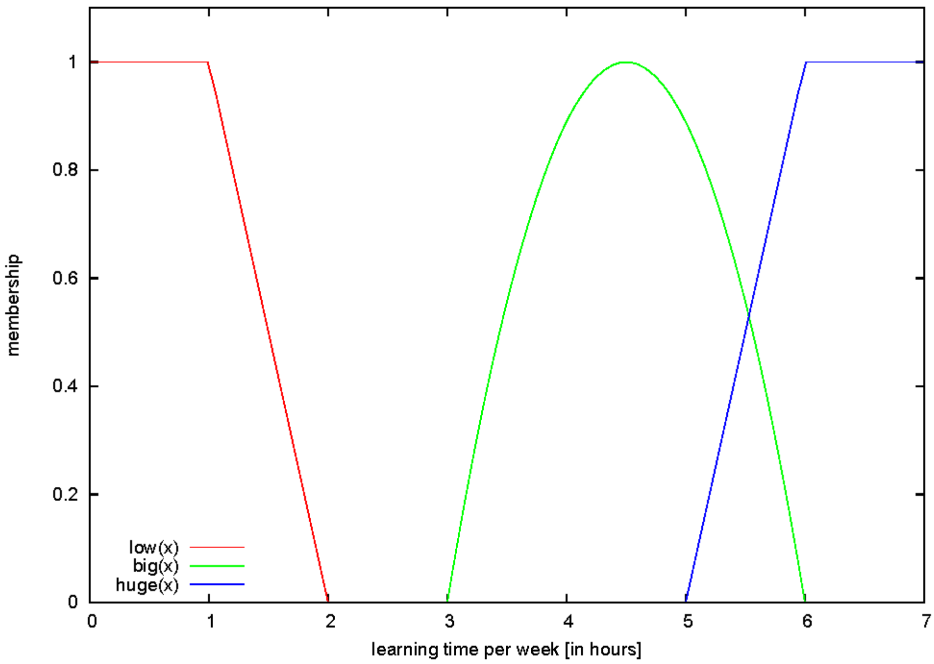
Consider the membership functions for the linguistic terms of the linguistic variable `mark`. Notice that outside the given range their values are zero!

$$\begin{aligned}
\texttt{very_good}(x) &= \exp(-2\,x^2) \text{ for } x \geq 1 \\
\texttt{good}(x) &= -(x-1)\,(x-3) \text{ for } x \in (1, 3) \\
\texttt{fair}(x) &= -(x-2)\,(x-4) \text{ for } x \in (2, 4) \\
\texttt{bad}(x) &= \min\{1, \frac{1}{2}(x-3)\} \text{ for } x > 3
\end{aligned}$$



Below you can find the membership functions for the linguistic terms of the linguistic variable `learning_time`. Again, outside the given range their values are zero!

$$\begin{aligned}
\texttt{huge}(x) &= \min\{x-5, 1\} \text{ for } x \geq 5 \\
\texttt{big}(x) &= -\frac{4}{9}(x-3)(x-6) \text{ for } x \in (3, 6) \\
\texttt{low}(x) &= \min\{2-x, 1\} \text{ for } x < 2
\end{aligned}$$



Based on the fuzzy proposition

if `learning_time` is `big` then `mark` is `good`,

the Lukaciewicz implication and the max-prod composition deduce the resulting fuzzy set over learning time for the given fuzzy fact

`mark` is `fair`.

Sketch the membership function.