

Homework from Fuzzy Logic. Choose the basic or advanced level.

Basic level

Exercises from conversions of representations of fuzzy sets and generators of fuzzy negations.

Exercise 2.1 Fuzzy set B is given by its collection of cuts:

$$\mathcal{R}_B(\alpha) = \begin{cases} \{A, B, C, D, E, F\}, & \alpha = 0, \\ \{A, B, C, D, E\}, & \alpha \in (0, 0.5), \\ \{A, B, C\}, & \alpha \in [0.5, 0.6), \\ \{A, B, C, D\}, & \alpha \in [0.6, 0.7), \\ \{A, B\}, & \alpha \in [0.7, 0.9), \\ \{A\}, & \alpha \in [0.9, 1]. \end{cases}$$

Find its vertical representation.

Exercise 2.2 Fuzzy set C is given by its collection of cuts:

$$\mathcal{R}_C(\alpha) = \begin{cases} \mathbb{R}, & \alpha = 0, \\ (\alpha, 6 - 2\alpha^2), & \alpha \in (0, 1]. \end{cases}$$

Find its vertical representation.

Exercise 2.3 Fuzzy set D is given by its collection of cuts:

$$\mathcal{R}_D(\alpha) = \begin{cases} \mathbb{R}, & \alpha = 0, \\ [-2 + \alpha, 2 - \alpha], & \alpha \in (0, 1), \\ \{0\}, & \alpha = 1. \end{cases}$$

Find its vertical representation.

Exercise 2.4 Find for which λ the formula

$$\neg_{\lambda} \alpha = \frac{1 - \alpha}{1 + \lambda \alpha}$$

defines a fuzzy negation \neg_{λ} . Draw a typical graph.

Exercise 2.5 Find the fuzzy negation with generator $i(\alpha) = \alpha^2$. Draw its graph.

Advanced level

Exercises from generators of negations.

Exercise 2.6 Decide whether the following statement is true:

For every two fuzzy negations \neg_1, \neg_2 , there is an increasing bijection $i: [0, 1] \rightarrow [0, 1]$ such that $\neg_2 \alpha = i^{-1}(\neg_1 i(\alpha))$ for all $\alpha \in [0, 1]$.

Exercise 2.7 Try to find a generator of the standard fuzzy negation, different from the identity.