Fuzzy Modelling

Exercise 5

Write a script to calculate the algebraic product and Lukasiewicz product of fuzzy sets A, B and C, which are described using Gauss membership functions:

a)

$$\mu_A(x) = e^{-(\frac{x-5}{2})^2}$$

$$\mu_B(x) = e^{-(\frac{x-6}{2})^2}$$

$$\mu_C(x) = e^{-(\frac{x-7}{2})^2}$$

$$\mu_D(x) = prod_{Alg}\left(\mu_A(x), \mu_B(x), \mu_C(x)\right)$$

$$\mu_E(x) = prod_{Luk}\left(\mu_A(x), \mu_B(x), \mu_C(x)\right)$$

C1 – red	Z1 – continuous line
C2 – magenta	Z2 – continuous line
C3 – green	Z3 – continuous line, line character „o"
C4 – blue	Z4 – continuous line, line character „x"
C5 – cyan	Z5 – continuous line, line character „+"
DS = 0.15	R = [0, 10]

b)

$$\mu_A(x) = e^{-(\frac{x-8}{3})^2}$$

$$\mu_B(x) = e^{-(\frac{x-9}{3})^2}$$

$$\mu_C(x) = e^{-(\frac{x-10}{3})^2}$$

$$\mu_D(x) = prod_{Alg}\left(\mu_A(x), \mu_B(x), \mu_C(x)\right)$$

$$\mu_E(x) = prod_{Luk}\left(\mu_A(x), \mu_B(x), \mu_C(x)\right)$$

C1 – cyan	Z1 – continuous line

C2 – red   Z2 – continuous line

C3 – blue   Z3 – continuous line, line character „*"

C4 – magenta   Z4 – continuous line, line character „o"

C5 – green   Z5 – continuous line, line character „d"

DS = 0.15   R = [0, 18]

Draw the membership functions $\mu_A(x)$, $\mu_B(x)$, $\mu_C(x)$, $\mu_D(x)$ and $\mu_E(x)$ on one graph in the range of R. Use the following colours $\mu_A(x)$ – C1, $\mu_B(x)$ – C2, $\mu_C(x)$ – C3, $\mu_D(x)$ – C4, $\mu_E(x)$ – C5, and continuous lines for each function and line characters Z1, Z2, Z3, Z4, Z5.

Sign the membership functions in the following way: $\mu_A(x)$ – MFA, $\mu_B(x)$ – MFB, $\mu_C(x)$ – MFC, $\mu_D(x)$ – MFD, $\mu_E(x)$ – MFE. Use a DS discretization step.

Write the equations describing the height and the power of a fuzzy set. Determine the height of the fuzzy sets: height(D), height(E) and the power of the fuzzy sets: card(D), card(E).