SISTEM ROBOT OTONOM

Section 6:

A brief introduction to fuzzy inference system

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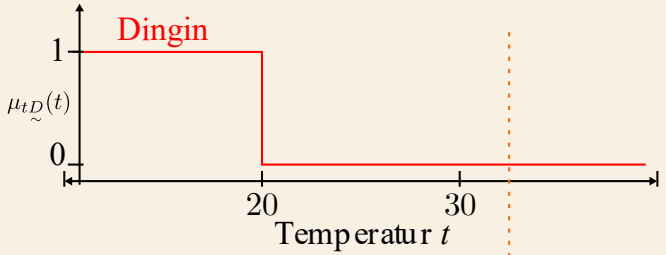
HARD VS SOFT

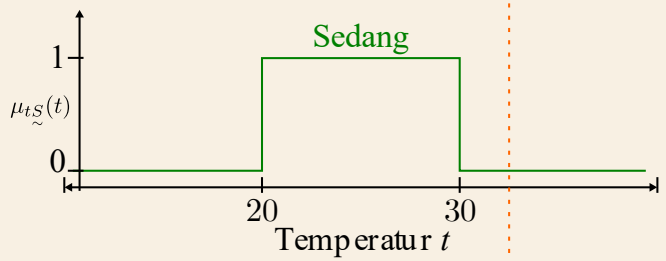
HARD LOGIC VS SOFT LOGIC

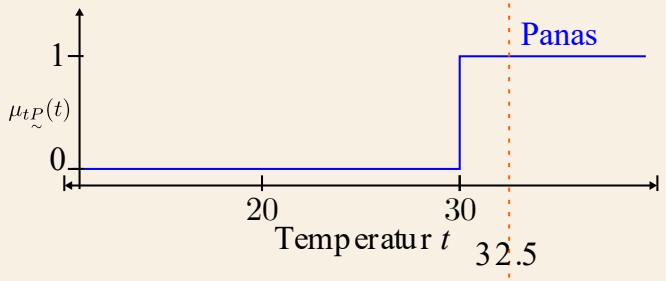
- Crisp variable based
  - 5v, 0v
  - 25 °C
  - "Jika suhu ruang < 25 °C, maka tengangan kipas = 0"
- Binary or Boolean
  - On, off
  - Laki-laki, Perempuan
  - Panas, hangat, dingin

- Fuzzy variable based
  - "Menyala", "Mati"
  - "Dingin", "Hangat"
  - Jika suhu ruang = "Dingin" maka tegangan kipas "Mati"
- Continuous range
  - 0.8 On
  - 0.7 Laki-laki, 0.3 Perempuan
  - 0.7 Panas, 0.2 hangat, 0.1 dingin

HARD LOGIC VS SOFT LOGIC

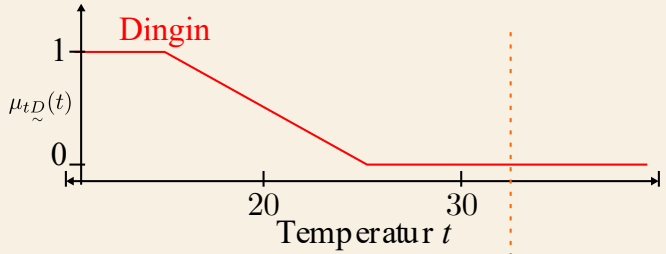


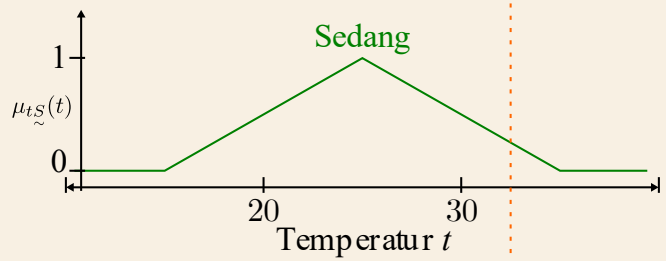


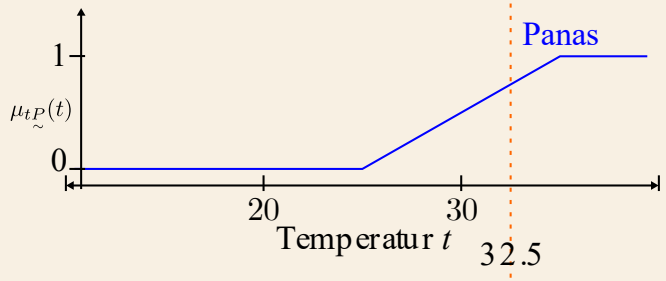


Temperatur 32.5 °C adalah
Panas

$$\text{Temperatur} \begin{cases} \text{Dingin}; & t < 20 \\ \text{Sedang}; & 20 <= t < 30 \\ \text{Panas}; & t >= 30 \end{cases}$$



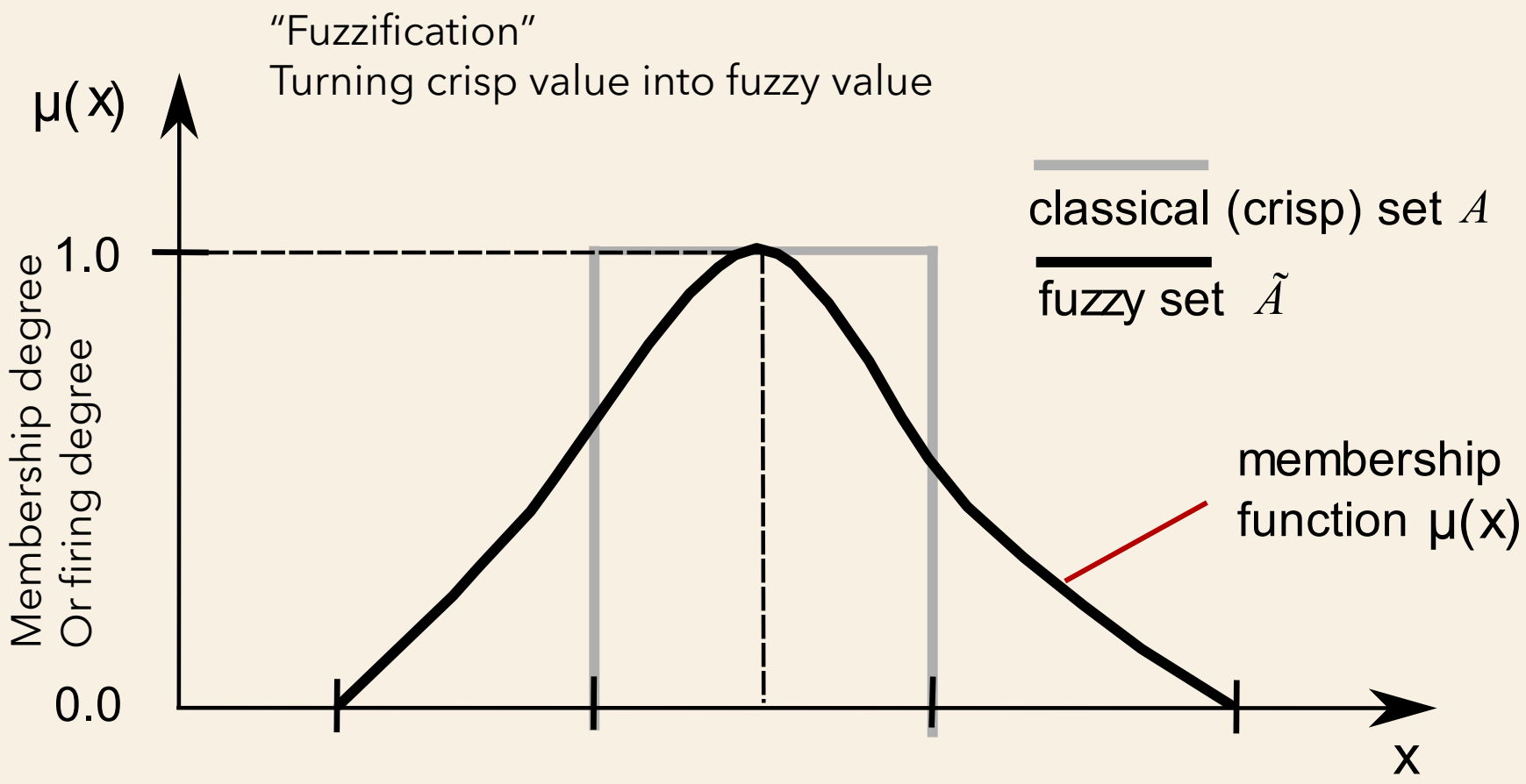




Temperatur 32.5 °C adalah
75% Panas, 25% Sedang
atau, 0% Dingin

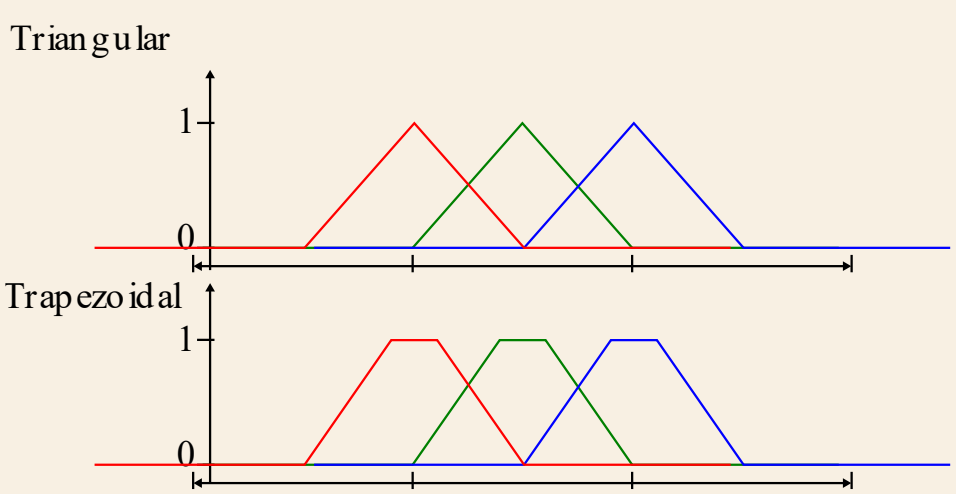
FUZZY MEMBERSHIP

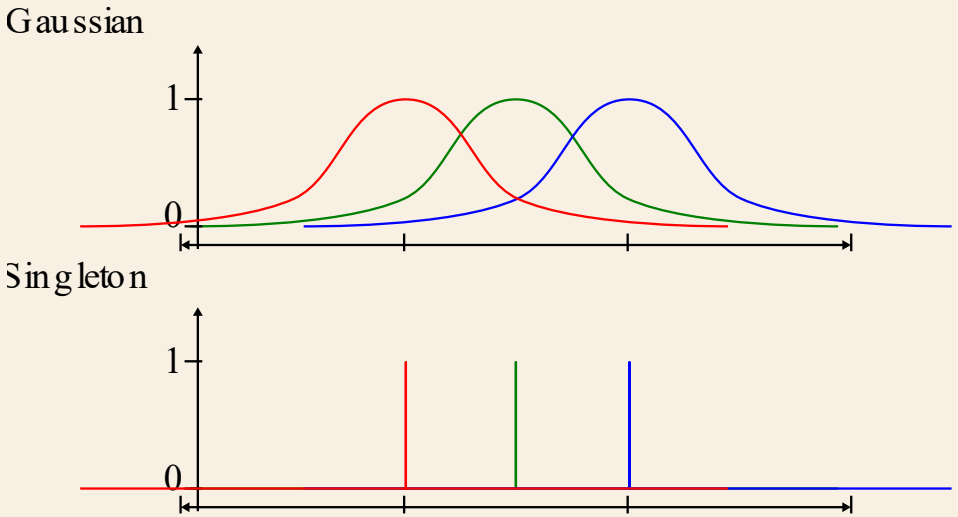
MEMBERSHIP FUNCTION



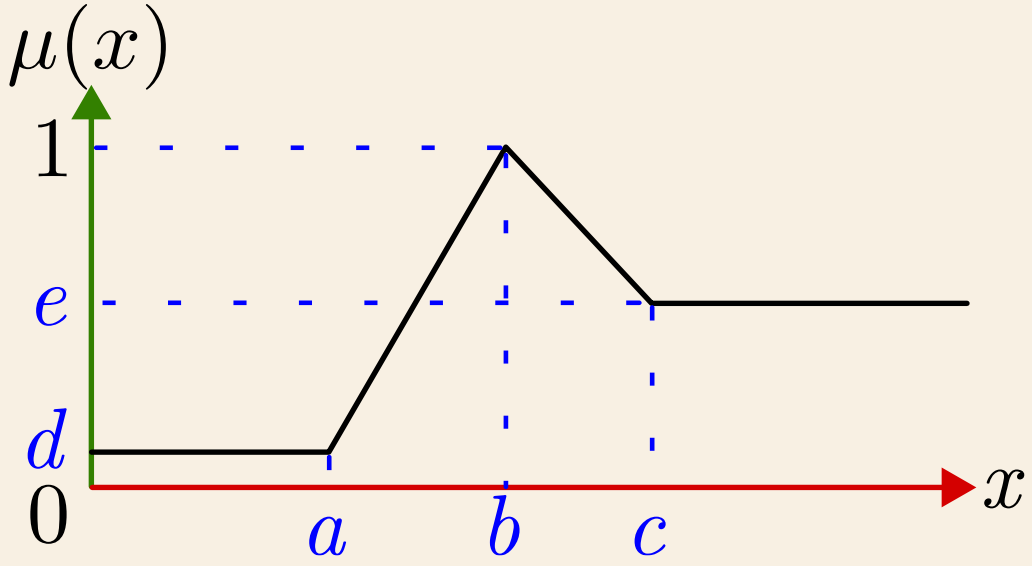
Wikipedia.org

MEMBERSHIP FUNCTION TYPES





TRIANGULAR MEMBERSHIP FUNCTION



$$\text{triangle}(x : a, b, c, d, e) = \begin{cases} d, & x < a \\ \dfrac{(x-a)}{(b-a)}, & a \leq x \leq b \\ \dfrac{(c-x)}{(c-b)}, & b \leq x \leq c \\ e, & x > c \end{cases}$$

ASSIGNMENT

- Create a membership function as shown in slide 4 in python.
- Input is temperature.
- Output is 3x1 vector of membership degree.
- Plot the membership degrees of temperature values ranging from 10 to 40 ^{o}C.

ASSIGNMENT

- Create a membership function for ultrasound reading in Copeliasim.
- The distance reading is fuzzified into 2 fuzzy variables: “Near” and “Far”.
- Do it for sensor [0], [2], [5], and [7].
- Plot your membership design.