

# 國立臺北科技大學

110 學年第一學期電機系博士班資格考試

## 模糊控制(Fuzzy Control)試題

第一頁 共二頁

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### 注意事項：

1. 本試題共【4】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。
5. 不准使用任何形式之計算器。

1. What is the correct sequence of steps taken in designing a fuzzy logic control? (15%)

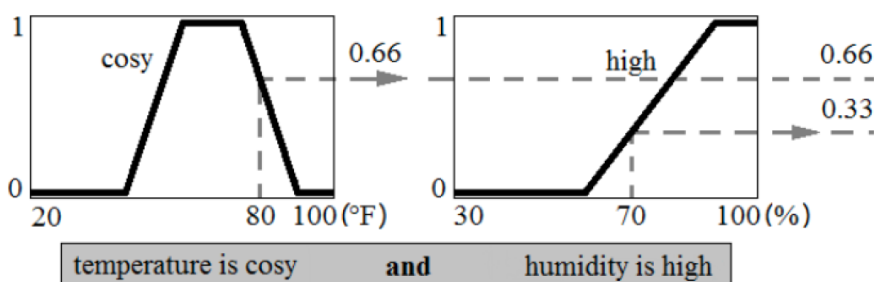
- (a) Fuzzification -> Rule evaluation -> Defuzzification
- (b) Rule evaluation -> Fuzzification-> Defuzzification
- (c) Fuzzy Sets -> Defuzzification -> Rule evaluation
- (d) Defuzzification -> Rule evaluation -> Fuzzification

2. Consider the three binary fuzzy relations defined by the relational matrices:

$$Q_1 = \begin{pmatrix} 0.1 & 0.2 & 0.3 \\ 0.4 & 0.5 & 0.6 \end{pmatrix}, \quad Q_2 = \begin{pmatrix} 0.4 & 0.5 & 0.1 \\ 0.3 & 0.6 & 0.9 \\ 0.2 & 0.7 & 0.8 \end{pmatrix}, \quad Q_3 = \begin{pmatrix} 0.1 & 0.2 \\ 0.3 & 0.4 \\ 0.5 & 0.6 \end{pmatrix}.$$

Compute the max-product compositions: (a)  $Q_1 \circ Q_2$  (b)  $Q_1 \circ Q_3$  and (c)  $Q_1 \circ Q_2 \circ Q_3$ . (30%)

3. Determine the value of the following defuzzification process, where input temperature is 80°F and input humidity is 70%. (25%)



4. Consider a two-input-one-output fuzzy system and two fuzzy rules:

*IF*  $x_1$  is  $B$  and  $x_2$  is  $A$ , *THEN*  $y$  is  $A$

*IF*  $x_1$  is  $A$  and  $x_2$  is  $B$ , *THEN*  $y$  is  $B$

where  $A$  and  $B$  are fuzzy sets in  $\mathbf{R}$  with membership functions

$$\mu_A(u) = \begin{cases} 1 - |u + 1| & \text{if } -2 \leq u \leq 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mu_B(u) = \begin{cases} 1 - |u| & \text{if } -1 \leq u \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

If the input to the fuzzy system is  $(x_1^*, x_2^*) = (-0.5, 0.5)$  and use the singleton fuzzifier.

Determine the output of the fuzzy system  $y^*$  using product inference engine and center average defuzzifier. (30%)