國立臺北科技大學

九十八學年第二學期電機系博士班資格考試

模糊控制 試題

注意事項：

1. 本試題共【1】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。

1. Given a fuzzy inference system with product inference engine, singleton fuzzifier, center-average defuzzification:

   If x_1 is A_1^l and x_2 is A_2^l and,..., and x_n is A_n^l, then y is b^l, $l = 1...M$,

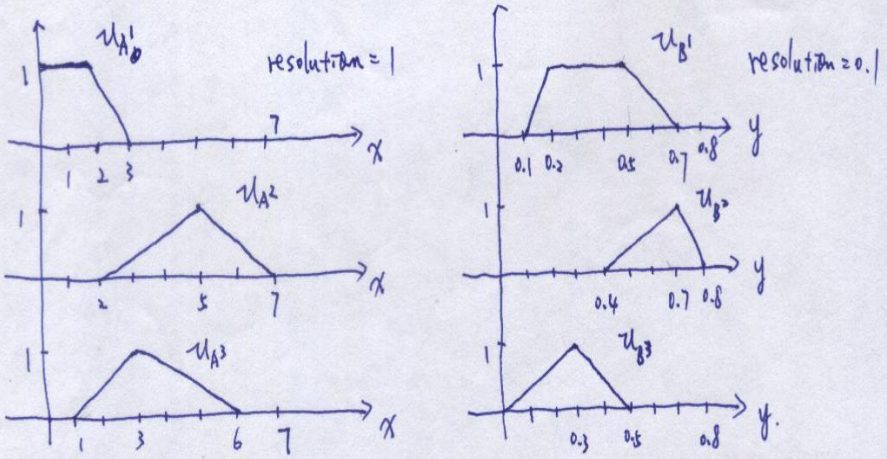
   where the membership function for the fuzzy set A_i^l, $i = 1...n$, $l = 1...M$, is a Gaussian function $N(\bar{x}_i^l, \sigma_i^l)$, and the membership function for the fuzzy set b^l is a fuzzy singleton, if you have N input pairs (x_0^p, y_0^p), $p = 1...N$, please show the derivation how you learn the parameters in the fuzzy inference system, i.e., the parameters $\bar{x}_i^l, \sigma_i^l, b^l, i = 1...n, l = 1...M$, by gradient descent approach. (30%)

2. Given a fuzzy system:

   If x is A^l, then y is B^l, $l = 1...3$,

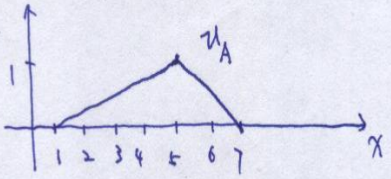
   where the membership functions for A^l and B^l, $l = 1...3$, are as following,

(30%)



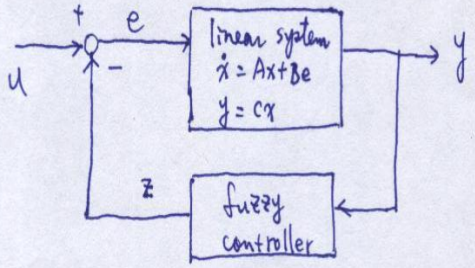
(a) please find the fuzzy relation between the input x and output y of the fuzzy system.

(b) If x is described by a fuzzy set A with membership as following, please calculate the output by fuzzy composition and the center-gravity defuzzification approach.



(c) Repeat part (b) to calculate the output using regular approach that calculates the degree of firing of every fuzzy rule.

3. Given a stable linear system as following, please show how you design your fuzzy controller so that the closed-loop system is L_p stable, $p \in [0, \infty)$. (20%)



4. Please describe how you design a fuzzy system to uniformly approximate the function $g(x_1, x_2) = 0.4+0.3x_1+0.26x_2-0.04x_1x_2$, defined on $U = [-1.5, 1.5] \times [-1.5, 1.5]$ with a required accuracy $\varepsilon = 0.1$. (20%)