國立臺北科技大學 101 學年第二學期

電機系博士班資格考試試題範本說明

一. 本系博士班資格考試試題為 A4 格式之版面。

二. 提供之試題範本自第 1 頁起提供 A4 格式之版面共 4 頁，若有不足請自行加頁。

三. 本範本以 Office 之 Word 文書應用軟體製作，命題委員至少須輸入之資料共四項，各項簡要說明如下：(前三項請依範本上之原字型與字型大小輸入，*前一項已代為執行合併列印套稿，請確認組別名稱與考試科目*。謝謝您！)

（一）【考試科目名稱】 ⟹ ［依所附檔案內考試科目名稱完整輸入取代］

（一） ⟹ ［請依試題題數輸入取代並增加必要之配分與各項特殊規定］

注意事項：

1. 本試題共【5】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:一小時。

（三）

試題本文 ⟹ ［請輸入題號與試題內容並完成排版與列印］

範本版面說明

試題本文之外方格線，係以單格表格並以隱藏格線方式設計，請在格線內命題，不要超出格線外；若有圖片，亦請於列印後黏貼於規劃版面內。謝謝！

四. 命題版面達 A4 共 2 頁(含)以上時，請修改範本第 1 頁之 第一頁　共一頁 為 第一頁　共一頁；若頁數更多，請類推修改增加之。

五. 本範本檔案及考試科目名稱檔案，將由本系以隨身碟提供命題委員，請命題委員在規劃版面內命題，並以 A4 紙張列印出試題繳交，隨身碟亦請交給本系。本系將直接列印後隨即製版，不再作其他處理，若有圖片請自行黏貼於妥當之版面位置。

國 立 臺 北 科 技 大 學

101 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【5】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. Suppose that a fuzzy subset A is defined by $A=\frac{1}{a}+\frac{0.6}{b}+\frac{0.4}{c}+\frac{0.2}{d}$. (a) What is the core of A? (b) Find α-level set (or α-cut) of A when α=0.3 and α=0.8. (c) How to reconstruct the fuzzy subset of A from the α-level sets? (10 分)

2. Suppose that the process in Fig. 1 is modeled by a second-order dynamic TSK fuzzy system that is constructed from the following two rules:

   L^1: IF $x(k)$ is A_1^1 and $x(k-1)$ is A_2^1 and $u(k)$ is B^1,
   THEN $x^1(k+1)=1.5x(k)+2.1x(k-1)-u(k)$.

   L^2: IF $x(k)$ is A_1^2 and $x(k-1)$ is A_2^2 and $u(k)$ is B^2,
   THEN $x^2(k+1)=0.3x(k)-3.4x(k-1)+0.5u(k)$.

   And that the controller in Fig. 1 is a TSK fuzzy system constructed from the following two rules:

   R^1: IF $x(k)$ is C_1^1 and $x(k-1)$ is C_2^1, THEN $u^1(k)=k_1^1x(k)+k_2^1x(k-1)$.

   R^2: IF $x(k)$ is C_1^2 and $x(k-1)$ is C_2^2, THEN $u^2(k)=k_1^2x(k)+k_2^2x(k-1)$.

   Design a closed-loop fuzzy control system from the dynamic TSK fuzzy system. (25 分)

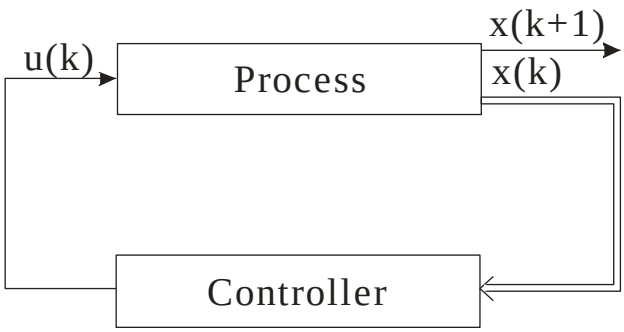

Fig. 1. Fuzzy control of fuzzy system model.

3. Suppose you are given 1,000 data (each is a 3-D datum, i.e., $[x_i\ y_i\ z_i]^t$, i=1,2,…,1000.) to be clustered into 5 clusters. (a) How to use the fuzzy c-means algorithm to cluster the given data. (b) How to apply the cluster centroids to establish the initial membership functions and the fuzzy rules of clusters? (25 分)

4. Design a fuzzy system *f(x)* to uniformly approximate the continuous function $g(x)=\sin(x)$ defined on U=[-3,3] (universe of discourse) with a required accuracy of ε=0.2, that is, $\sup_{x\in U}|g(x)-f(x)|<\varepsilon$. (20 分)

5. Assuming there are only two rules in a fuzzy rule base:

   Rule 1: If X is A_1 and Y is B_1, then Z is C_1,

   Rule 2: If X is A_2 and Y is B_2, then Z is C_2.

   Also assuming $x_0=4$ and $y_0=8$ are sensor readings for input variables X and Y, respectively. (a) Determine the antecedent firing strength of each rule and find the defuzzified output based on the following membership functions. (b) If the consequent parts of rule 1 and rule 2 become Z=0.3(X+Y) and Z=0.4X+0.3Y+2, respectively. Find the defuzzified output and compare it with the results derived in part (a). (20 分)

$$\mu_{A1}=\begin{cases}\dfrac{x-2}{3}, 2\le x\le 5\\ \dfrac{8-x}{3}, 5<x\le 8\end{cases}\quad \mu_{A2}=\begin{cases}\dfrac{x-3}{3}, 3\le x\le 6\\ \dfrac{9-x}{3}, 6<x\le 9\end{cases}$$

$$\mu_{B1}=\begin{cases}\dfrac{y-5}{3}, 5\le y\le 8\\ \dfrac{11-y}{3}, 8<y\le 11\end{cases}\quad \mu_{B2}=\begin{cases}\dfrac{y-4}{3}, 4\le y\le 7\\ \dfrac{10-y}{3}, 7<y\le 10\end{cases}$$

$$\mu_{C1}=\begin{cases}\dfrac{z-1}{3}, 1\le z\le 4\\ \dfrac{7-z}{3}, 4<z\le 7\end{cases}\quad \mu_{C2}=\begin{cases}\dfrac{z-3}{3}, 3\le z\le 6\\ \dfrac{9-z}{3}, 6<z\le 9\end{cases}$$