國 立 臺 北 科 技 大 學

106 學年第二學期電機系博士班資格考試

智慧型控制(Artificial Intelligence Control)試題

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. Fuzzy sets $A(x)\subset U$ and $B(y)\subset V$, universe of discourse $U=\{x_1, x_2, x_3, x_4\}$ and $V=\{y_1, y_2, y_3\}$; $A=\frac{0.9}{x_1}+\frac{0.7}{x_2}+\frac{0.3}{x_3}+\frac{0.8}{x_4}$, $B=\frac{0.3}{y_1}+\frac{0.5}{y_2}+\frac{0.6}{y_3}$. Find the relation $R=A\times B$ using the Cartesian product. (25%)

2. Let $U=\{x_1, x_2, x_3\}$ and $V=\{y_1, y_2\}$. Suppose that $x\in U$, $y\in V$ and use the following fuzzy rule:

   IF x is A, *THEN* y is B

   Where the fuzzy sets A and B are defined as $A=\frac{0.7}{x_1}+\frac{0.8}{x_2}+\frac{0.5}{x_3}$ and $B=\frac{0.9}{y_1}+\frac{0.4}{y_2}$. Give ($x$ is A',) where $A'=\frac{0.3}{x_1}+\frac{0.4}{x_2}+\frac{0.5}{x_3}$, Derive a output conclusion in the form (y is B',) where the fuzzy relation $A\rightarrow B$ is interpreted using Mamdani's product implication and *min* for the *t*-norm. (25%)

3. Figure 1. shows a 3-inputs/1-output perceptron. The perceptron uses the hardlim transfer function and the input ($\mathbf{p}_1$ and $\mathbf{p}_2$)/ target output (t_1 and t_2) prototype vectors are as follows:

$$\{\mathbf{p}_1=\begin{bmatrix}1\\-1\\-1\end{bmatrix}, t_1=[0]\} \text{ and } \{\mathbf{p}_2=\begin{bmatrix}1\\1\\-1\end{bmatrix}, t_2=[1]\}.$$

   Using the perceptron learning rule, find the weight matrix **w** and bias b with the initial **w**(0) = [0.5 -1 -0.5] and $b(0)$ = 0.5 to make correct classification of the two input vectors. (25%)

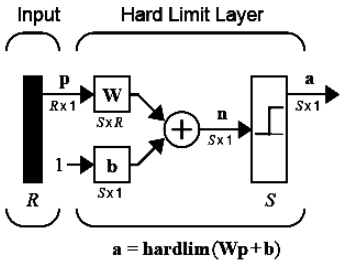

Figure 1.

4. Consider the function $F(\mathbf{x}) = x_1^2 + 2x_1x_2 + 2x_2^2 + x_1 + 2$, calculating the stationary point in order to find the minimum or maximum of the function F(x). (25%)