



القسم.....التحكم..... أسئلة الامتحان النهائي لمادة : ...التحكم الذكي.....

لطلبة الفصل: السابع..... رمز المادة.....CT414.... التاريخ 2020/03/01

الفصل الدراسي : خريف...2019..... اسم الأستاذ/المنسق : ..... عبدالسلام احمد.....الزمن.....ساعتان.....

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== Answer all questions ==

1- A factory process control operation involves two linguistic parameters consisting of pressure [400: 1000 psi] and temperature [130: 140°F] in a fluid delivery system. Each parameter is characterized in fuzzy linguistic terms as follows:

$$\text{"Low Temperature"} = \frac{1}{131} + \frac{0.8}{132} + \frac{0.6}{133} + \frac{0.4}{134} + \frac{0.2}{135} + \frac{0}{136}$$

$$\text{"High Temperature"} = \frac{0}{134} + \frac{0.2}{135} + \frac{0.4}{136} + \frac{0.6}{137} + \frac{0.8}{138} + \frac{1}{139}$$

$$\text{"High Pressure"} = \frac{0}{400} + \frac{0.2}{600} + \frac{0.4}{700} + \frac{0.6}{800} + \frac{0.8}{900} + \frac{1}{1000}$$

$$\text{"Low Pressure"} = \frac{1}{400} + \frac{0.8}{600} + \frac{0.6}{700} + \frac{0.4}{800} + \frac{0.2}{900} + \frac{0}{1000}$$

(a) Find the following membership functions:

- (i) Temperature not very low
- (ii) Temperature not very high
- (iii) Temperature not very low and not very high

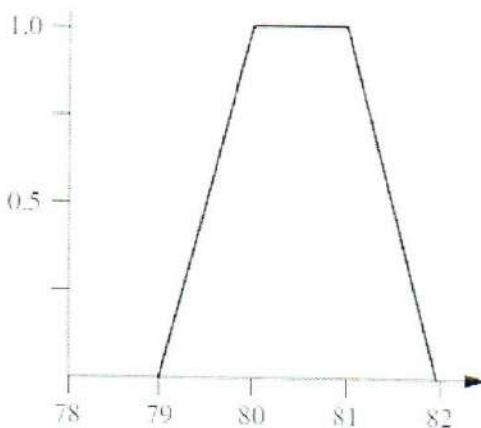
(b) Find the following membership functions:

- (i) Pressure more or less high
- (ii) Pressure very low
- (iii) Pressure more or less high or very low

(8 marks)

2- For the following fuzzy set, calculate the value of the crisp set using centroid, first, middle and last of maxima.

Note: For the centroid method, it is enough to write the equation without calculations.



(8 marks)

- 3- Design a fuzzy logic controller for controlling the amount of cleaning liquid in a washing machine. The controller has two inputs: the amount of the clothes (0-12 Kg) with linguistic variables {Light, Heavy, Very Heavy} and the amount of dirt with linguistic variables {Almost clean, Dirty, Soiled}, the output is the amount of cleaning liquid with linguistic variables {Little, Medium, Much}.
- a- Draw the membership functions of the inputs and output.  
 b- Show the fuzzy rules for the system using Mamdani's inference method. (8 marks)

- 4- A neural network (Single-layer two-input perceptron) is trained to perform a classification task for an OR operation. Given  $w_1=0.2$ ,  $w_2=0.3$ ,  $\alpha=0.1$  and  $\theta=0.4$ , train the perceptron for one epoch using step activation function. Write the results in a table form

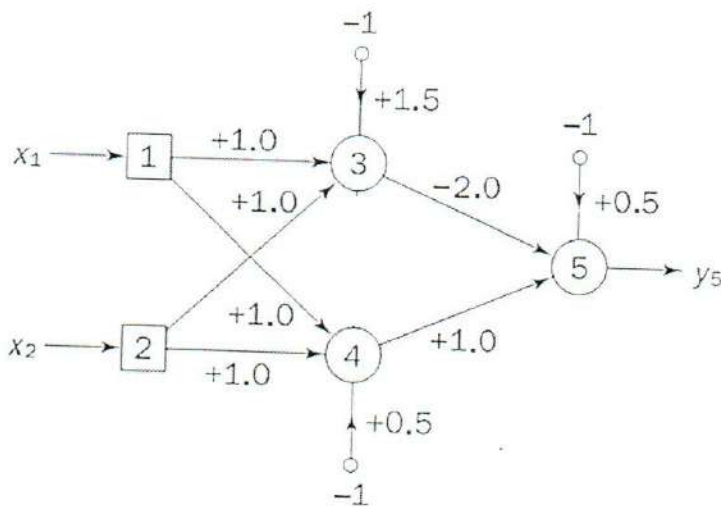
Inputs		Desired Output $y_d$	Initial weights		Actual Output $y$	Error $e(p)$	Final weights	
$x_1$	$x_2$		$w_1$	$w_2$			$w_1$	$w_2$

$$w_i(p + 1) = w_i(p) + \alpha \cdot x_i(p) \cdot e(p)$$

$$e(p) = y_d(p) - y(p)$$

(8 marks)

- 5- The following neural network is assumed to solve the X-OR problem using the sign function. Prove that the network is able to do the job to all inputs successfully.



(8 marks)

◇ All the Best ◇