UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2010/11

COURSE NAME	: NEURAL NETWORK AND FUZZY LOGIC
COURSE CODE	: BEM 4233
PROGRAMME	: BACHELOR OF ELECTRICAL ENGINEERING WITH HONOUR
EXAMINATION DATE	: APRIL / MAY 2011
DURATION	: 2 HOURS 30 MINUTES
INSTRUCTION	: ANSWER FOUR (4) QUESTIONS ONLY

THIS PAPER CONSISTS OF FIVE (5) PAGES

Q1 A multilayer neural network is represented in Figure Q1. The network is trained using Backpropagation learning algorithm with weights initial condition as below: $w_1 = 0.01$, $w_2 = -0.01$, $w_3 = 0.11$, $w_4 = 0.21$, $w_5 = -0.11$, $w_6 = -0.2$, $w_7 = -0.15$, $w_8 = 0.31$, $\Delta w_1 = 0.1$, $\Delta w_2 = -0.02$, $\Delta w_3 = 0.01$, $\Delta w_4 = -0.11$, $\Delta w_5 = 0.0$, $\Delta w_6 = -0.011$, $\Delta w_7 = -0.05$, $\Delta w_8 = 0.01$

Activation function for hidden and output layer is $f(net) = \frac{1}{1+e^{-net}}$, learning rate of network is $\eta = 0.5$.

Neural network is used to evaluate AND GATE for input $x_1 = 1$, $x_2 = 1$, $x_3 = 1$, and target $t = 1$.

(a) Determine the value of each weight after one iteration

(22 marks)

(b) Calculate and draw MSE graph

(3 marks)

Q2 (a) Explain what neural network is and how it work.

(6 marks)

(b) Describe the brief history of neural network.

(11 marks)

(c) Explain why neural network must be train before apply to solve the problem.

(4 marks)

(d) Explain the potential advantages of neural network for intelligent control.

(4 marks)

Q3 (a) Develop weights updating formulation for first iteration of neural network shown in Figure Q3. Where η is network learning rate, α is momentum, network weights increment are $\Delta w_1, \Delta w_2, \cdots, \Delta w_{12}$, and activation function $f(net) = \frac{1}{1+e^{-net}}$

(20 marks)

(b) Differentiate between neural network and fuzzy logic.

(5 marks)

Q4. A fuzzy control system has table rules as shown in Table Q4 and membership as triangular function.

(a) Develop the active rules related with error (e) is 2.5 and differential error (de) is -1.25, if
Universe discourse for each variable is
Error: NB [-6,-4,-2], N [-4,-3,-2], NS [-3,-2,-1], Z [-2,0,2], PS [1,2,3], P [2,3,4], PB [2,4,6]
Differential error: NB [-6,-5,-4], N [-5,-3,-1], NS [-2,-1,0], Z [-1,0,1], PS [0,1,2], P [1,3,5], PB [4,5,6]
Output: NB [-8,-6,-4], N [-6,-4,-2], NS [-4,-2,0], Z [-2,0,2], PS [0,2,4], P [2,4,6], PB [4,6,8]

(5 marks)

(b) Calculate the inference process from Q4(a)

(18 marks)

(c) Calculate output crisp using COG method of defuzzification

(2 marks)

Q5 Fuzzy control system is applied to control the water level in a tank. The inlet pipe is not equipped with valve; it means the inlet flow rate is constant. Whereas the outlet valve is equipped with valve, then outlet flow rates set by setting the valve opening. Therefore, to maintain the water level in a constant level, the valve opening of the tank outlet pipe is controlled using fuzzy controller. And it is known that the fuzzy control system has fuzzy set as below:

Water level: Very Low (VL), Low (L), Medium (M), High (H), Very High (VH)
Outlet flow rate: Very Slow (VS), Slow (S), Medium (M), Fast (F), Very Fast (VF)
Outlet valve opening: Very Small (VS), Small (S), Medium (M), Big (B), Full (F)

(a) Construct the table of rule of the fuzzy control system for this problem.

(15 marks)

(b) Determine the possible rule from Q5(a).

(10 marks)

Q6 (a) Draw the fuzzy control system block.

(5 marks)

(b) Explain each element definition from Q6 (a).

(8 marks)

(c) Explain why input and output variables very important to know in designing fuzzy control system?

(5 marks)

(d) Differentiate between crisp and fuzzy logic

(7 marks)

FINAL EXAMINATION

SEMESTER/SESSION	: I / 2010/11	PROGRAMME	: 4 BEM
COURSE NAME	: NEURAL NETWORK AND FUZZY LOGIC	COURSE CODE	: BEM 4233

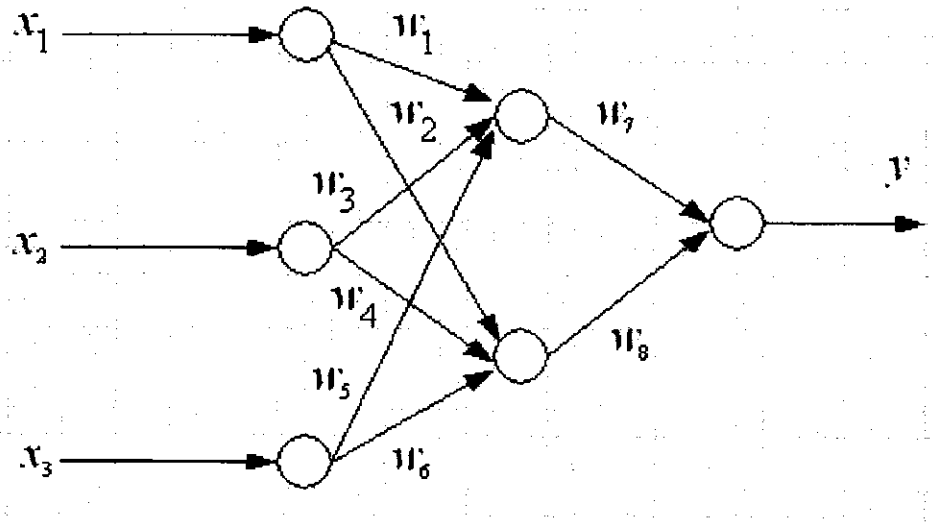

Figure Q1

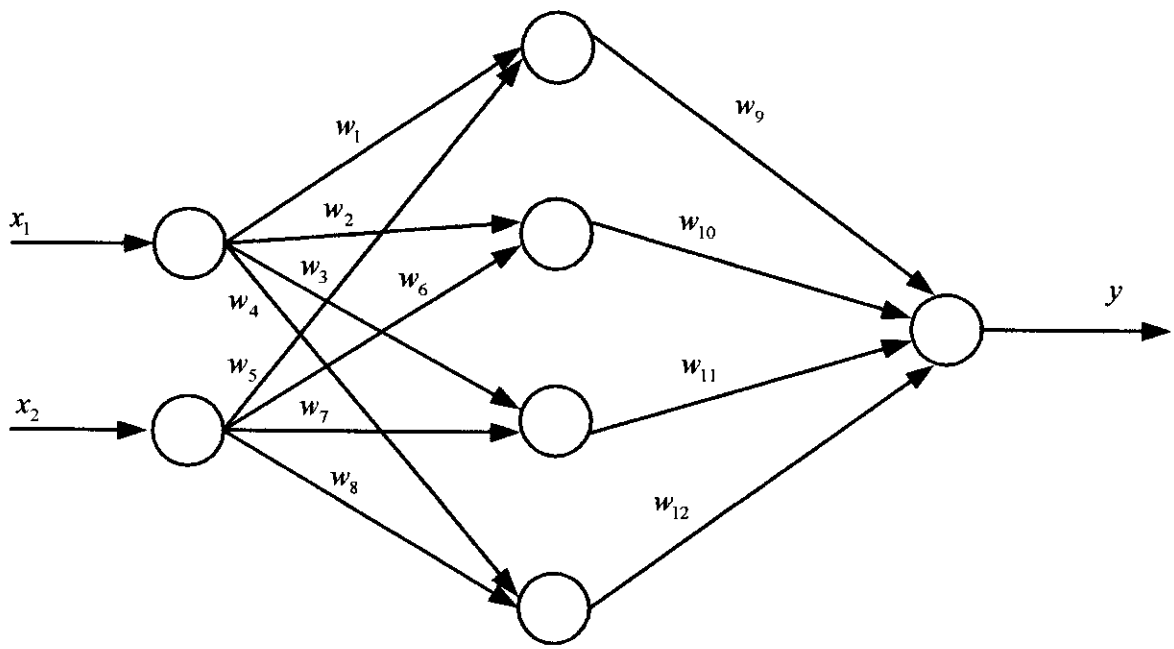

Figure Q3

FINAL EXAMINATION

SEMESTER/SESSION : I / 2010/11
COURSE NAME : NEURAL NETWORK AND FUZZY LOGIC
PROGRAMME : 4 BEM
COURSE CODE : BEM 4233

Tabel Q4: Rule tabulation

u		e						
		NB	N	NS	Z	PS	P	PB
de	NB	NB	NB	NB	N	Z	P	PB
	N	NB	NB	NB	N	PS	P	PB
	NS	NB	NB	N	NS	PS	P	PB
	Z	NB	N	NS	Z	PS	P	PB
	PS	NB	N	NS	PS	P	PB	PB
	P	NB	N	NS	P	PB	PB	PB
	PB	NB	N	Z	P	PB	PB	PB