



Second Exam, Summer Semester: 2016/2017

Dept. of Computer Engineering

Course Title:	Neural Networks and Fuzzy Logic	Date:	16/08/2017
Course No:	630514	Time Allowed:	60 Minutes
Lecturer:	Dr. Qadri Hamarsheh	No. Of Pages:	5

Instructions:

- **ALLOWED:** pens, calculators and drawing tools (**no red color**).
- **NOT ALLOWED:** Papers, literatures and any handouts. Otherwise, it will lead to the non-approval of your examination.
- **Shut down** Telephones, and other communication devices.

Please note:

- This exam paper contains 4 questions totaling 20 marks
- Write your name and your matriculation number on every page of the solution sheets.
- All solutions together with solution methods (explanatory statement) must be inserted in the labelled position on the solution sheets.
- You can submit your exam after the first hour.

Basic notions: The aims of the questions in this part are to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of basic concepts: different Learning Rules- Perceptron Learning Rule, backpropagation algorithm, Hopfield network, Bidirectional Associative Memory, Kohonen self-organizing map and their Matlab Implementation.

Question 1 Multiple Choice

(8 marks)

Identify the choice that best completes the statement or answers the question.

- 1) **Input units** of a Neural Network can be **adjusted** during a learning process.
 - a) **True**
 - b) **False**
- 2) State whether **Hebb's law** is **supervised** learning or **unsupervised** type?
 - a) **Supervised**
 - b) **Unsupervised**
 - c) **Either supervised or unsupervised**
 - d) **Can be both supervised and unsupervised**
- 3) In **Hebbian** learning, the **initial** weights are set?
 - a) **To zero**
 - b) **Random**
 - c) **Near to target value**
 - d) **None of the above**
- 4) In a three layer network, **shape** of dividing surface (decision boundary) is determined by?

a)	Number of units in second layer
b)	Number of units in third layer
c)	Number of units in second and third layer
d)	None of the mentioned

5) What is the biggest difference between **Widrow & Hoff's Delta Rule** and the **Perceptron Learning Rule** for learning in a single-layer feedforward network?

a)	There is no difference.
b)	The Delta Rule is defined for step activation functions, but the Perceptron Learning Rule is defined for linear activation functions.
c)	The Delta Rule is defined for sigmoid activation functions, but the Perceptron Learning Rule is defined for linear activation functions.
d)	The Delta Rule is defined for linear activation functions, but the Perceptron Learning Rule is defined for step activation functions.

6) What is **gradient descent**?

a)	Method to find the absolute minimum of a function
b)	Method to find the absolute maximum of a function
c)	Maximum or minimum, depends on the situation
d)	None of the mentioned

7) The number of fundamental memories M_{max} (**Most perfectly retrieved**) that can be stored in the **n-neuron** Hopfield network is limited by

a)	$M_{max} = 0.15 n$	b)	$M_{max} = \frac{n}{4 \ln n}$
c)	$M_{max} = \frac{n}{2 \ln n}$	d)	None of above

8) What is **asynchronous** update in a network?

a)	Update to all units is done at the same time
b)	Change in state of any number of units drive the whole network
c)	Change in state of any one unit drive the whole network
d)	None of the mentioned

Familiar and Unfamiliar Problems Solving: The aim of the questions in this part is to evaluate that the student has some basic knowledge of the key aspects of the lecture material and can attempt to solve familiar and unfamiliar problems different Learning Rules- Perceptron Learning Rule, backpropagation algorithm, Hopfield network, Bidirectional Associative Memory, Kohonen self-organizing map and their Matlab Implementation.

Question 2

(4 marks)

Explain the process of learning in **Perceptron's training algorithm** (write the steps of the algorithm).

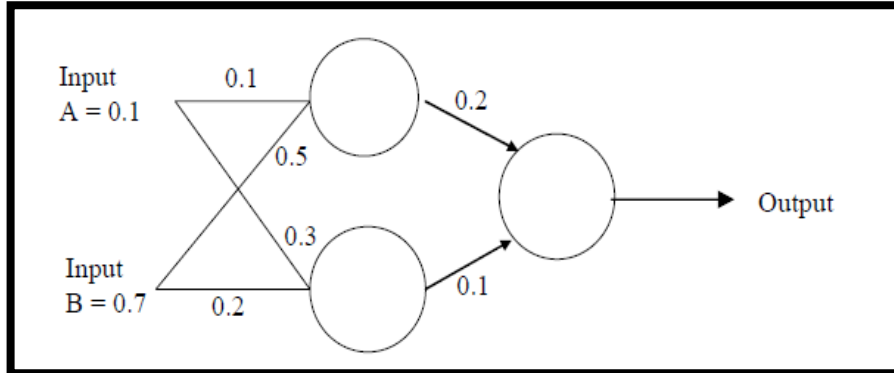
Solution

Question 3

(5 marks)

Consider the **backpropagation neural network** as shown below, assume that the neurons have a **logistic sigmoid activation function**, do the following:

- a) Perform a **forward pass** on the network. (2 marks)
- b) Perform a **reverse pass** (training) once (**target = 1, $\alpha=1$**). (3 marks)



Solution

Question 4

(3 marks)

Determine the weight matrix for an auto-associative, **discrete Hopfield Network** (as discussed in class) that has four neurons and has “learned” the patterns **(1, -1, -1, 1)** and **(-1, 1, 1, -1)**.

Solution

GOOD LUCK