TECHNICAL UNIVERSITY OF MOMBASA

INSTITUTE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR:

BTIT2012S & BSSC2013S

EIT4351; EIT4417: NEURAL NETWORKS

END OF SEMESTER EXAMINATION

SERIES: APRIL2016

TIME: 2HOURS

DATE: 10May2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE(Compulsory)

a) Explain the statement "neural networks learn from examples" **(4 marks)**

b) State examples of specific areas of application for neural networks that employ classification and forecasting. **(4 marks)**

c) State any four beneficiaries and briefly explain how they benefit from neural networks **(4 marks)**

d) With a sketch of a biological neuron, explain how it processes inputs. **(6 marks)**

e) With the aid of a diagram describe the elements of a neural network. **(4 marks)**

f) Distinguish between supervised and unsupervised learning as applied in neural networks **(4 marks)**

g) Outline the design considerations for a neural network **(4 marks)**

Question TWO

a) From the following set of house features, write a hypothesis that has complex features which creates a boundary line that is non-linear. **(4 marks)**

$$x_1 = \text{size}$$
$$x_2 = \text{\# bedrooms}$$
$$x_3 = \text{\# floors}$$
$$x_4 = \text{age}$$
$$\cdots$$
$$x_{100}$$

b) Sketch a non-linear boundary line that could be plotted from two of the housing attributes above.

(4 marks)

c) Explain why it difficult to for an algorithm to recognize cars in computer vision. (2 marks)
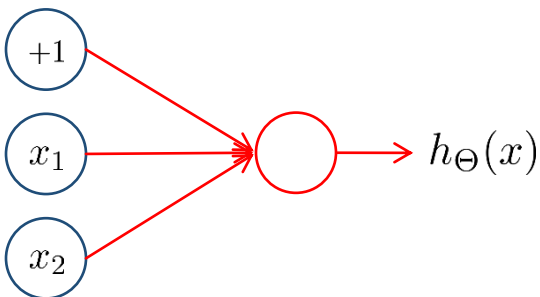
d) Draw a simple neural network with three input units, one hidden layer with three units, and one output unit. Show how the following hypothesis is generated: (10 marks)

$$h_\Theta(x) = a_1^{(3)} = g(\Theta_{10}^{(2)} a_0^{(2)} + \Theta_{11}^{(2)} a_1^{(2)} + \Theta_{12}^{(2)} a_2^{(2)} + \Theta_{13}^{(2)} a_3^{(2)})$$

Question THREE

a) Using the AND operation as shown in the neural network given where

$$x_1, x_2 \in \{0, 1\}; \, y = x_1 \text{ AND } x_2$$

Given the parameter values as -30, 20,20, respectively, determine the output of the hypothesis.

(5 marks)

b) Determine using parameters (-10, 20, 20) the hypothesis output for:

$$x_1 \ \mathrm{OR} \ x_2$$

And using parameters (-10, 20) the hypothesis output for: NOT x_1
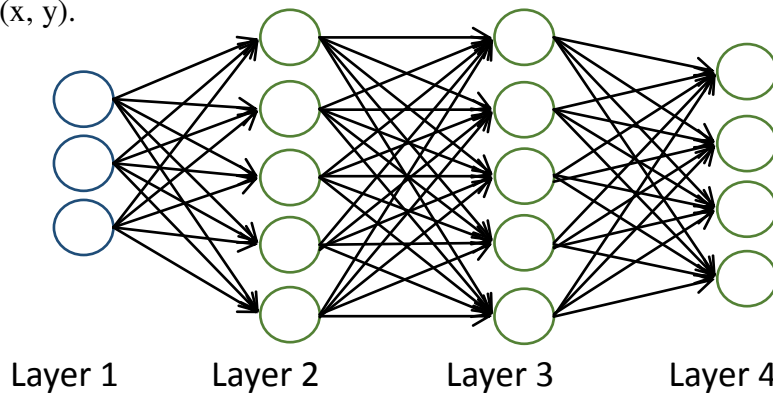
(6 marks)

c) Combine the three gates to build a neural network showing the hidden layer having the output of AND and OR gates, and the output of NOT gate. Determine the final output of the hypothesis.   (9 marks)

Question FOUR

a i)Given the neural network, state the equation for the activation (forward propagation) of each layer for one training set example

(x, y).   (8 marks)

Layer 1   Layer 2   Layer 3   Layer 4

ii) Explain the implication of the forward propagation in the network   (2 marks)

b i) Using the network in (a) above, state the equations for the back propagation algorithm.(6 marks)

ii) Explain the purpose of carrying out back propagation in the neural network   (4 marks)

Question FIVE

a) Explain the steps for training a neural network.   (10 marks)

b) With the aid of diagrams, explain the difference between bias and variance.   (6 marks)

c) Compare the advantages and disadvantages of a small and a large neural network.   (4 marks)