



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF
SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

SCO 411: NEURAL NETWORKS

DATE: 1/8/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY)

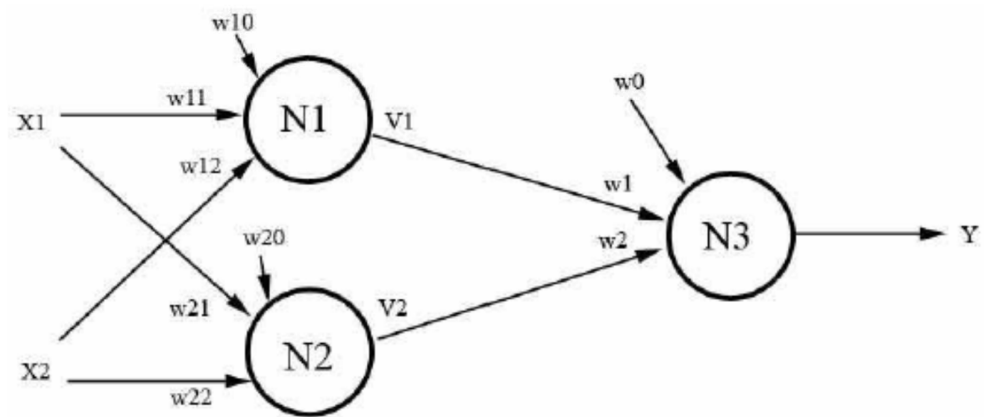
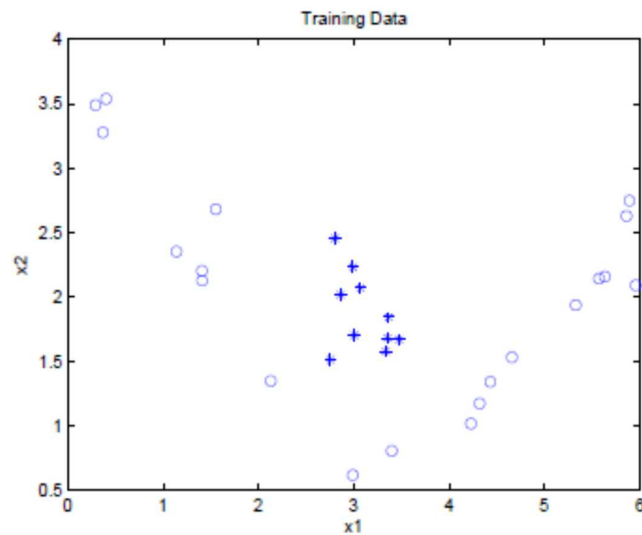
- a) Explain any three reasons for studying ANN (6 marks)
- b) Discuss the components of Artificial Neural Network including the model of *McCulloch-Pitts Neuron* (12 marks)
- c) Explain Hopfield learning algorithm (5 marks)
- d) Explain the applications of Neural Networks in robotics (7 marks)

QUESTION TWO (20 MARKS)

- a) Consider the following classification training data (where “+” = true or 1 and “O” = false

or 0) and neural network model that uses the sigmoid response function $g(t) = \frac{1}{1+e^{-t}}$.

We would like to set the weights (w) of the neural network so that it is capable of correctly classifying this dataset. Please plot the decision boundaries for N1 and N2 (e.g., for neuron N1, the line where $w_{10} + w_{11} * X_1 + w_{12} * X_2 = 0$) on the first two graphs. In the third graph, which has axes V_2 and V_1 , plot $\{V_1(x_1, x_2), V_2(x_1, x_2)\}$ for a few of the training points and provide a decision boundary so that the neural net will correctly classify the training data. (9 marks)



- b) Describe the three differences between the human brain and today's computers (6 marks)
- c) Use the equation $Y_1(t) = [X_1(t-1)] \text{ XOR } [X_2(t-3) \text{ AND NOT } X_2(t-2)]$ to fill the table below. (5 marks)

$X_2(t-3)$	$X_2(t-2)$	AND NOT	$X_1(t-1)$	XOR

QUESTION THREE (20 MARKS)

- a) A student would like to decide whether to attend a wedding party or not. The decision variables are weather condition, availability of transport, and completion of assignment. Model the decision with respect to Artificial Neural Network. (10 marks)
- b) The ANN in this question predicts the results of soccer matches. The network receives information about the two competing teams and the conditions of the match and is supposed to predict how many goals each team will score. With this knowledge, you could bet on the projected winner team and gain a lot of money. Let us say that every team consists of 20 players. Design this ANN by providing the following input data (10 marks)
- The skill level of every player on each of the two teams. Skill is rated by a group of soccer reporters on a scale from 0 (“is unable to kick the ball”) to 10 (“world class player”).
 - The number of matches that each team has played during the last two weeks. There are never more than seven matches in that period of time.
 - The statistics of former matches between the same two teams within the past 10 years (e.g., Team A won 30% of the matches, Team B 45%, and 25% of the matches were tied).
 - The continent that each team comes from (North America, South America, Europe, Africa, Asia, or Australia).
 - Where the match takes place (Team A’s stadium, Team B’s stadium, or neutral place)
 - The phase of the soccer season (early season vs. late season).

QUESTION FOUR (20 MARKS)

- a) Explain the three phases of training ANN by back propagation (9 marks)
- b) Explain the equation $Dis\ tan\ ce(LMS) = \frac{1}{2} \sum_p (T_p - O_p)^2$ (3 marks)
- c) Given the following points $(x_1 = -1, x_2 = 1)$ with target 1, $(x_1 = 1, x_2 = 1)$ with target 1, and $(x_1 = 0, x_2 = 2)$ with target 0. If the classifier has a bias term with a value is fixed at 1, write down the inequalities, represent them in weight space and indicate the feasible region. (8 marks)

QUESTION FIVE (20 MARKS)

- a) Discuss three types of learning rules (6 marks)
- b) Using diagrams, describe the types of artificial neural networks (architectures)(7 marks)
- c) Using a typical example, explain the application of ANN in Data analysis (7 marks)