



# TECHNICAL UNIVERSITY OF MOMBASA

## INSTITUTE OF COMPUTING AND INFORMATICS

### DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

#### UNIVERSITY EXAMINATION FOR:

BMCS 12S

EIT4454: MACHINE LEARNING

END OF SEMESTER EXAMINATION

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: 10 May 2016**

#### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

#### Question ONE (Compulsory)

- a) Explain three applications of machine learning. (6 marks)
- b) Define machine learning as earlier defined by Arthur Samuel (1959). (2 marks)
- c) With a suitable example, explain the statement  $p(a | b, c) = p(a | c)$  (3 marks)
- d) Draw a graphical representation for the expression:  
 $p(A, B, C, D, E, F, G) = p(A|B)p(C|B)p(B|D)p(F|E)p(G|E)p(E|D) p(D)$  (3 marks)
- e) Explain the difference between entropy and information gain with the help of mathematical expressions. (4 marks)
- f) Differentiate the two types of tree pruning. (4 marks)
- g) State Bayesian theory and explain all the component probabilities. (4 marks)
- h) Explain the difference between supervised and unsupervised learning. (4 marks)

## Question TWO

a) State the Linear Regression hypothesis and explain by choosing suitable parameter values and at least three sketches how the hypothesis determines the best model. (7 marks)

b) Explain with a suitable plot sketch how to create the cost function of a logistic regression as given:

$$J(\theta_1) = \frac{1}{2m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2 \quad (8 \text{ marks})$$

c) Explain the difference between the terms: over fitting and under fitting and state the intuition of over fitting in terms of the cost function. (5 marks)

## Question THREE

a) Using the sigmoid function show how the Logistic Regression model is achieved (6 marks)

b) Starting from the linear regression cost function show how the logistic regression cost function is achieved. (12 marks)

c) State any four optimization algorithms. (2 marks)

## Question FOUR

a) Describe Neural Networks (5 marks)

b) With suitable a suitable Neural Network and equations, explain the concept of forward propagation (12 marks)

c) Explain the term back propagation as used in Neural Network. (3 marks)

## Question FIVE

a) Describe the process of achieving Support Vector Machines boundary lines starting from the logistic regression cost function. (16 marks)

b) Explain the following terms: i) margin of a linear classifier; ii) support vectors. (4 marks)