Machakos University College

(A Constituent College of Kenyatta University)

UNIVERSITY EXAMINATIONS 2013/2014

SCHOOL OF COMPUTING AND APPLIED SCIENCES

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SCO 109: LINEAR ALGEBRA FOR COMPUTER SCIENCE

DATE: 2ND APRIL, 2014 **TIME:** 8.30 a.m. – 10.30 a.m.

INSTRUCTIONS:

*Answer question **ONE** which is Compulsory and any other **TWO** questions*

Question 1: (30 marks)

(a) Given that $A = \begin{bmatrix} -1 & 6 \\ 4 & 11 \end{bmatrix}, B = \begin{bmatrix} 2 & -5 \\ -1 & 3 \end{bmatrix}, C = \begin{bmatrix} 7 & -2 \\ -10 & 1 \end{bmatrix}$

Verify that A(B+C) = AB + BC (6 marks)

(b) Given that $A = \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

(c) Use Cramers rule to solve the following system of equations

13x + 8y – 14z = 1

7x – 4y – z = 0

8x – 5y + 4z = 24 (10 marks)

(d) Given that $T = \begin{bmatrix} 5 & -1 \\ 1 & 3 \end{bmatrix}$, find

(i) The eigen values of the matrix T. (3 marks)

(ii) The eigen vectors of the matrix T associated with the eigenvalues in (i) above. (2 marks)

Question 2

(a) Determine whether the following sets of vectors are linearly dependent or linearly independent.

(i) (1, 0, 1) (2, 1, 1), (1, 1, 2) (4 marks)

(ii) (-3, 1, 2) 4, 0, -8) (6, -1, -4) (4 marks)

(b) Find the rank of the following matrix and comment on the question of non-singularity

$$B = \begin{bmatrix} 0 & -1 & -4 \\ 3 & 1 & 2 \\ 6 & 1 & 0 \end{bmatrix}$$ (4 marks)

(c) Use any appropriate method to find the determinant of the following matrix:

$$K = \begin{bmatrix} 2 & 7 & 0 & 1 \\ 5 & 6 & 4 & 8 \\ 0 & 0 & 9 & 0 \end{bmatrix}$$

Question 3

(a) Define a markov chain. (2 marks)

(b) In a certain county, three parties A, B, C always nominate candidates for governor. The probability of winning an election depends on the party in power and is given by the transition matrix p below:-

	Party in office next term		
Party in office now	A	B	C
A	0.5	0.4	0.1
B	0.4	0.5	0.1
C	0.3	0.3	0.4

Suppose that the probability of winning the next election is given by the initial probability vector (0.4, 0.4, 0.2), find

(i) The probability of each party winning the second election. (4 marks)

(ii) The probability of each party winning the third election. (4 marks)

(iii) Find the steady state probabilities for the parties in the long-run. (10 marks)

Question 4

(a) Let $T: IR^3 \longrightarrow IR^3$ be a linear transformation defined by
$T(x, y, z) = (x + 2y, y, 3x - y + z)$

(i) Find the matrix T with respect to the standard basis $\{(1,0,0),(0,1,0),(0,0,1)\}$ (5 marks)

(ii) Find the matrix T with respect to the basis $\{(1,0,0),\ (1,1,0),(1,1,1)\}$ (5 marks)

(iii) Show that by using the basis in (ii), the image of V = (7, 2, 1) is TV = (11, 2, 20), by first getting the coordinates of V with respect to the basis. (5 marks)

(b) Use the quick sort algorithm to sort the following list in ascending order:
25, 10, 5, 6, 13, 2, 9, 8 (5 marks)

Question 5

(a) Two variables x and y are related by the equation $y = ax + b$. The following table shows experimental values of x and y.

x	-2	0	2	4
y	-1	1	2.2	4.2

Use matrix method to find by linear regression the line of best fit for the above data. (10 marks)

(b) Use graphical method to solve the linear programming problem
Maximize $Z = 5x + 6y$
Subject to: $x + y \leq 40$
$x + 2y \leq 75$
$x \geq 0, \quad y \geq 0$ (10 marks)