KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: **MATH 211**

COURSE TITLE: **LINEAR ALGEBRA I**

STREAM: **Y2S2**

DAY: **WEDNESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **24/03/2010**

INSTRUCTIONS:

1. Answer question ONE and any other TWO questions
2. Begin each question on a separate page
3. Show your workings clearly and neatly.

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

a) Find the determinant of A= $\begin{pmatrix} 2 & -1 & 1 \\ -1 & 0 & 3 \\ 2 & 1 & -4 \end{pmatrix}$ (4 marks)

b) Compute the inverse of the following matrices using row reduction method

i) $\begin{pmatrix} 3 & 1 \\ 5 & 2 \end{pmatrix}$ (3 marks) ii) $\begin{pmatrix} 2 & -3 \\ 4 & 4 \end{pmatrix}$ (3 marks)

c) Given **v** = (3,-1,-2) find the a unit vector that,

i) Points in the same direction as **v** (3 marks)

ii) Points in the opposite direction as **v** (2 marks)

d) Find the angle between the vectors p = 2i + 3j + 4k and q = 4i – 3j + 2k (5 marks)

e) Determine if the following sets of vectors will span R^3

i) V_1 = (2,0,1) , v_2 = (-1,3,4) and v_3 = (1,1,-2) (5 marks)

ii) V2 = (1,2,-1) , v2 = (3,-1,1) and v3 = (-3,8,-5) (5 marks)

QUESTION TWO (20 MARKS)

a) Given u=(3,-1,4) and v=(2,0,1) compute each of the following

i) u x v and v x u (6 marks)

ii) u x u (2 marks)

iii) u.(u x v) and v.(u x v) (4 marks)

iv) Angle between u and v (4 marks)

b) Find the rank of the following matrix

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 2 & 1 & 0 \end{pmatrix}$$ (4 marks)

QUESTION THREE (20 MARKS)

a) Given u = (-2,3,1,-1) and v = (7,1,-4,-2) verify the cauchy-schwarz inequality and the triangular inequality (6 marks)

b) Determine if the following sets of vectors are linearly independent or linearly dependent

i) $V_1 = (1,1,-1,2)$, $v_2 = (2,-2,0,2)$ and $v_3 = (2,-8,3,-1)$ (5 marks)

ii) v_1` = (1,-2,3,-4) , v_2 = (-1,3,4,2) and v_3 = (1,1,-2,-2) (5 marks)

c) Show that $(A^n)(A^{-1}) = I$ (4 marks)

QUESTION FOUR (20 MARKS)

a) Suppose that **u** = (u_1,u_2,u_3) and **v** = (v_1,v_2,v_3) are two vectors in 3- space then,
Show that $u.v = u_1v_1 + u_2v_2 + u_3v_3$ (7 marks)

b) Solve the following systems of equations using cramers rule

$$4x + 2y + 4z = 16$$
$$2x - 6y + 6z = -8$$
$$8x + 4y - 2z = 2$$

(7 marks)

c) Evaluate each of the following if A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

i) A^2 (3 marks) ii) A^3 (3 marks)

QUESTION FIVE (20 MARKS)

a) For the following matrices compute

$$A = \begin{pmatrix} 10 & -6 \\ -3 & -1 \end{pmatrix} \qquad B = \begin{pmatrix} 1 & 2 \\ 5 & -6 \end{pmatrix}$$

i) Det(A) (3 marks)
ii) Det(B) (3 marks)
iii) Det(AB) (3 marks)
iv) Det A^{-1} (2 marks)

b) Show that u = (3,0,1,0,4,-1) and v = (-2,5,0,2,-3,-18) are orthogonal and verify that the pythagorean Theorem holds (8 marks)