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University Examinations 2012/2013

SECOND YEAR, FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

ICS 2211: NUMERICAL LINEAR ALGEBRA

DATE: AUGUST 2013 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) i) Show that if A and B are invertible square matrices of the same order, then AB is also invertible and $[AB]^{-1} = B^{-1}A^{-1}$. (6 Marks)

ii) Using Gauss – Jordan method, find the inverse of the matrix

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ (5 Marks)

b) i) Using Gauss elimination method find the solution of the following system of linear equations

$$x_1 - x_2 + x_3 = 4$$
$$2x_1 + x_2 - 3x_3 = 0$$
$$x_1 + x_2 + x_3 = 2$$ (10 Marks)

ii) Find the Eigen values and Eigen vectors of the matrix.

$$A = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & -1 \\ 3 & 3 & -1 \end{bmatrix}$$ (9 Marks)

QUESTION TWO (20 MARKS)

a) Prove that if the inverse of a square matrix exists, then it is unique. (5 Marks)

b) Using the Partition method, find the solution of the linear system of equations below

$x_1 + x_2 + x_3 = 1$
$4x_1 + 3x_2 - x_3 = 6$
$3x_1 + 5x_2 + 3x_3 = 4$ (15 Marks)

QUESTION THREE (20 MARKS)

Given the matrix $A = \begin{bmatrix} 3 & 2 & 2 \\ 1 & 3 & 1 \\ 5 & 3 & 4 \end{bmatrix}$

i. Find $|A|$ (3 Marks)
ii. Find A^{-1} (10 Marks)
iii. Find the matrix B such that
$AB = \begin{bmatrix} 3 & 4 & 2 \\ 1 & 6 & 1 \\ 5 & 6 & 4 \end{bmatrix}$ (7 Marks)

QUESTION FOUR (20 MARKS)

Find the eigenpairs λ_j *and* V_j for the matrix

$$A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$

Also show that the eigenvectors are linearly independent. (20 Marks)

QUESTION FIVE (20 MARKS)

a) Given the system of linear equations
$x + y + z = 6$
$x + 2y + 3z = 10$
$x + 2y + \lambda z = \mu$
Find the values of λ and μ for which the linear system has
i. No solution (3 Marks)
ii. A unique solution (3 Marks)
iii. Infinite solution (4 Marks)

b) Find the solution to the linear system
$2x_1 + 3x_2 - x_3 = 4$
$x_1 - 2x_2 + x_3 = 6$
$x_1 - 12x_2 + 5x_3 = 10$
By Cramer's Rule. (10 Marks)