UNIVERSITY OF MANITOBA

DATE: March 11, 2010 — MIDTERM II
TITLE PAGE
COURSE: MATH 1210 — TIME: 1 hour
EXAMINATION: Classical and Linear Algebra — EXAMINER: Garba/Mohammed

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FAMILY NAME: (Print in ink) _____

GIVEN NAME(S): (Print in ink) _____

STUDENT NUMBER: _____

SIGNATURE: (in ink) _____
(I understand that cheating is a serious offense)

Please indicate your instructor by placing a check mark in the appropriate box below.

☐ MWF 9:30 - 10:20 S. Garba. ☐ MWF 1:30 - 2:20 T. Mohammed.

INSTRUCTIONS TO STUDENTS:

This is a 1 hour exam. **Please show your work clearly.**

No texts, notes, or other aids are permitted. There are no calculators, cellphones or electronic translators permitted.

This exam has a title page, 5 pages of questions, one of which is blank for rough work. Please check that you have all the pages. DO NOT REMOVE the blank page.

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 50 points.

Answer all questions on the exam paper in the space provided beneath the question. If you need more room, you may continue your work on the reverse side of the page, but CLEARLY INDICATE that your work is continued.

Question	Points	Score
1	7	
2	5	
3	14	
4	12	
5	12	
Total:	50	

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[7] 1. Given the vectors

$\overrightarrow{u} = (2, 5, -3), \quad \overrightarrow{v} = (7, -4, -2), \quad \overrightarrow{w} = (1, 3, -2)$ do the following:

(a) Find $\overrightarrow{u} \cdot \overrightarrow{v}$. Are $\overrightarrow{u}$ and $\overrightarrow{v}$ orthogonal?

(b) Find $\overrightarrow{v} \cdot \overrightarrow{w}$. Are $\overrightarrow{v}$ and $\overrightarrow{w}$ orthogonal?

(c) Find $\overrightarrow{u} \times \overrightarrow{w}$.

[5] 2. Find the point of intersection of the plane $3x - 6y - 5z = 12$ and the line given by $x = 3 + 4t\,;\ y = 7 - 3t\,;\ z = -2 + 5t$.

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[14] 3. Let $A = \begin{pmatrix} 3 & -2 & -1 \\ 2 & -1 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 0 & -2 \\ 1 & 2 \\ -1 & 3 \end{pmatrix}$, $C = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}$, $D = \begin{pmatrix} 1 & 2 & -1 \\ 0 & 1 & -1 \\ -2 & -1 & 1 \end{pmatrix}$, $E = \begin{pmatrix} 3 & 2 & 1 \end{pmatrix}$ and $F = \begin{pmatrix} 4 \\ 1 \\ -3 \end{pmatrix}$.

(a) Indicate if the expression is defined or undefined by placing a check mark in the appropriate column. If it is defined, then indicate its size.

EXPRESSION	UNDEFINED	DEFINED	SIZE
$BF + A$			
$A^T B^T + D$			
$(2B)(3A) - 7C$			
$CA + B^T D$			
$(EB)^T + AF$			

(b) Evaluate (If possible) the expression BA.

(c) Evaluate (if possible) the expression $5D - 2I_3$.

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[12] 4. For each of the following matrices, do ALL of the following:

(a) Decide if the matrix is in row echelon form. If it is, write 'yes' besides the REF for that matrix, else write 'no'.

(b) Decide if the matrix is in reduced row echelon form. If it is, write 'yes' besides the RREF for that matrix, else write 'no'.

(c) Interpret the matrix as row equivalent to the augmented matrix of a system of equations (having variables x_1, x_2, etc.). Find the solution to that system.

$$A = \begin{pmatrix} 1 & 2 & -2 & 4 \\ 0 & 1 & -3 & 5 \\ 0 & 0 & 1 & -2 \end{pmatrix}$$

REF:
RREF:
solutions:

$$B = \begin{pmatrix} 1 & 0 & -2 & 0 & 5 & 0 & -5 \\ 0 & 1 & 2 & 0 & -3 & 0 & 1 \\ 0 & 0 & 0 & 1 & 2 & 0 & -3 \\ 0 & 0 & 0 & 0 & 0 & 1 & 8 \end{pmatrix}$$

REF:
RREF:
solutions:

$$C = \begin{pmatrix} 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 3 & 0 & 0 \end{pmatrix}$$

REF:
RREF:
solutions:

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[12] 5. Solve the following system using Gauss-Jordan elimination:

$$\begin{aligned} x + 3y + 3z &= 0 \\ 2x + 7y + 2z &= 6 \\ -x + y - 4z &= 9 \end{aligned}$$

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