THE UNIVERSITY OF MANITOBA

March 9, 2005 — Term Test II
DEPARTMENT AND COURSE NO.: 136.101 — PAGE NO.: 1 OF 3
EXAMINATION: Applied Finite Mathematics — TIME: 1 HOUR
EXAMINERS: P. Penner L04, M. Davidson L05

Instructions:

1. Answer all questions on the machine-scored answer sheet provided.
2. **Calculators** and other aids are **not permitted.**
3. The examination invigilators may not interpret or explain questions for you.
4. Blank paper (2 sheets) for rough work is attached to the end of the exam paper. You may remove the blank pages if you like but be careful not to loosen the staple.
5. You **must** hand back the entire examination paper, except for the scrap paper.

Multiple Choice

- Place the answers on the machine scored answer sheets provided. **Use only pencil.**
- Ensure that you write in the identifying information requested, and that you **encode your student number** in the upper right hand corner of the answer sheet.
- For each question choose the single answer that is the best.
- You may guess if you wish. There is no additional penalty for guessing. You will receive 1 mark for each correctly answered question and 0 marks for any incorrectly answered or omitted question.

Questions A

1. Row echelon form for all matrices means that every row of the matrix begins with a one, but has one more zero to the left of that one than the previous row.
   a) yes
   b) no

2. In the row reduced echelon form for a matrix a leading one is any element which has the value one.
   a) yes
   b) no

3. Given the matrix $A=\begin{bmatrix} 3 & -1 & 2 & 12 \\ 1 & 2 & 3 & 11 \\ 2 & -2 & 1 & 2 \end{bmatrix}$, which of the following two row operations were used to obtain the matrix $B=\begin{bmatrix} 1 & 2 & 3 & 11 \\ 0 & -7 & -7 & -21 \\ 2 & -2 & 1 & 2 \end{bmatrix}$?
   a) $R_2 \leftarrow R_2 + R_1$ and $R_3 \leftarrow R_3 - 2R_1$;
   b) $R_2 \leftrightarrow R_1$ and $R_1 \leftarrow R_3 + R_1$;
   c) $R_1 \leftarrow R_1 - 3R_3$ and $R_2 \leftarrow R_2 - \frac{1}{3}2R_1$;
   d) $R_2 \leftrightarrow R_1$ and $R_2 \leftarrow R_2 - 3R_1$;
   e) none of the above.

4. $C=\begin{bmatrix} 1 & 2 & 3 & 11 \\ 0 & 1 & 1 & 3 \\ 0 & -6 & -5 & -20 \end{bmatrix}$ is obtained from the above matrix B. Which of the following two row operations were used to obtain the matrix C from B?
   a) $R_2 \leftarrow R_2 + R_3$ and $R_3 \leftarrow R_3 - 2R_1$;
   b) $R_2 \leftarrow R_2 + R_3$ and $R_3 \leftarrow R_3 - 2R_1$;
   c) $R_2 \leftarrow \frac{-1}{7}R_2$ and $R_3 \leftarrow R_3 - 2R_1$;
   d) $R_2 \leftarrow \frac{-1}{7}R_2$ and $R_3 \leftarrow R_3 + 6R_2$;
   e) none of the above.

5. $D=\begin{bmatrix} 1 & 2 & 3 & 11 \\ 0 & 1 & 1 & 3 \\ 0 & 0 & 1 & -2 \end{bmatrix}$ is the above matrix A in row echelon form. That means that A is the augmented matrix of a system of linear equations which has
   a) a unique solution;
   b) no solution;
   c) infinitely many solutions;
   d) exactly two solutions;
   e) none of the above.

6. The above matrix A (See question 3 and 5) is the augmented matrix of a system of linear equations that has the following as its solution:
   (a) $x = 7, y = 5, z = 2$;
   (b) $x = 11 - 3t, y = 3 - t, z = t$;
   (c) $x = 11 - 2s - 3t, y = 3 - t, z = t$;
   (d) $x = 7, y = 5, z = -2$;
   (e) none of the above.

See Reverse Side

$M = \begin{bmatrix} 1 & 4 & 5 \\ 2 & 9 & 10 \\ 3 & 13 & 16 \end{bmatrix}$. Calculate M^{-1} and answer the following four questions.

7. The element in position 2,1 of M^{-1} is
   (a) -2;
   (b) 1;
   (c) 2;
   (d) 0;
   (e) none of the above.

8. The element in position 1,3 of M^{-1} is
   (a) -2;
   (b) -5;
   (c) -1;
   (d) 0;
   (e) none of the above.

9. The element in position 3,3 of MM^{-1} is
   (a) -2;
   (b) 1;
   (c) 16;
   (d) 0;
   (e) none of the above.

10. If the matrices X and B are defined by

$X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, then the linear system MX=B has the following solution:
   (a) $x = -5, y = 0, z = 0$;
   (b) $x = 1, y = 1, z = -1$;
   (c) $x = 14, y = -2, z = -1$;
   (d) $x = 1 + t, y = 1 + t, z = t$;
   (e) none of the above.

11. If $E = \begin{bmatrix} 1 & 2 & 3 & 11 \\ 0 & 1 & 1 & 3 \\ 0 & 0 & 0 & -2 \end{bmatrix}$ is the augmented matrix of a linear system of equations, then the linear system has:

   a) a unique solution;
   b) no solution;
   c) infinitely many solutions;
   d) exactly two solutions;
   e) none of the above.

12. If $F = \begin{bmatrix} 1 & 2 & 3 & 11 \\ 0 & 1 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ is the augmented matrix of a linear system of equations, then the linear system has the following as its solution:

   a) $x = 5, y = 3, z = 0$ is a unique solution;
   b) $x = 11, y = 3, z = 0$ is a unique solution;
   c) $x = 5 - t, y = 3 - t, z = t$;
   d) $x = 5 + t, y = 3 + t, z = t$;
   e) none of the above.

Questions B

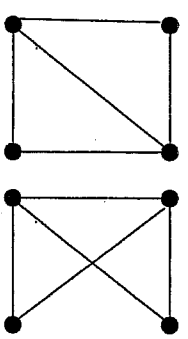
13. Does a simple graph with vertex degrees {0, 3, 3, 3, 5} exist?
   a) yes
   b) no

14. Does a simple graph with vertex degrees {1, 3, 3, 3, 4} exist?
   a) yes
   b) no

15. The degree of a node of a simple graph is the number of edges which are joined to this node.
   a) true
   b) false

16. A simple graph is any graph which has no parallel edges
   a) true
   b) false

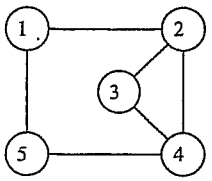
17. Are the following two graphs equivalent?



   a) yes
   b) no

18. How many simple graphs are there on 4 vertices which have exactly five edges?
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5 or more

19. What is the edge set for Graph G1?

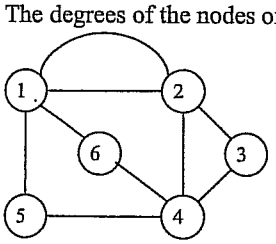


Graph G 1

a) (3,4),(2,3),(2,4),(4,5),(3,4),(1,4)
b) (3,4),(3,3),(2,4),(4,5),(1,2),(1,5)
c) (3,4),(2,3),(2,5),(4,5),(1,2),(1,5)
d) (3,4),(2,3),(2,4),(4,5),(1,3),(1,4)
e) (3,4),(2,3),(2,4),(5,4),(1,2),(1,5)

20. Choose one of the following which applies to the Graph G1.
a) It has an Euler circuit
b) It has an Euler path
c) It does not have a Hamilton Circuit
d) It is not a connected graph
e) None of the above.

21. The degrees of the nodes of G2 are



Graph G 2

a) 2, 3, 2, 3, 2. 2
b) 1, 2, 3, 4, 5, 6
c) 4, 4, 2, 4, 2, 2
d) 3, 3, 2, 4, 2, 2
e) None of the above

22. Choose one of the following which applies to the Graph G2.
a) It has an Euler circuit
b) It has an Euler path which is not closed
c) It has a Hamilton Circuit
d) It is a simple graph
e) None of the above

23. An Euler circuit of the Graph G2 is:
a) 1,2,3,4,6,1,5,4
b) 1,5,4,6,1,2,3,4
c) 1,6,4,3,2,4,5,1
d) 1,2,1,6,4,3,2,4,5,1
e) None of the above

24. An Hamilton circuit of the Graph G2 is:
a) 1,2,3,4,6,1,5,1
b) 1,5,4,3,2,1
c) 1,6,4,3,2,4,5,1
d) 1,2,1,6,4,3,2,4,5,1
e) None of the above