

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 1 of 9

TIME: 2 hours

EXAMINER: Borgersen, Mohammed
Trim

INSTRUCTIONS:

1. Single-line display calculators are permitted. No other aids.
2. Attempt all questions.
3. Answer the multiple choice questions in pencil on the bubble sheet provided.
4. Write solutions to long-answer problems 13–18 in the space provided.
5. Check that your examination booklet contains pages numbered from 1 to 9.
6. Fill in the information requested below.
7. Return all materials at the end of the examination.

Student Name (Print): Family _____ First _____

Student Signature: _____

Student Number: _____

Instructor's Name: _____

(R. Borgersen for A01, D. Trim for A02, T. Mohammed for A03)

Question Number	Maximum Mark	Assigned Mark
1–12	2 each	
13	16	
14	10	
15	15	
16	10	
17	11	
18	14	
Examination Total	100	

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 2 of 9

TIME: 2 hours

EXAMINER: Borgersen, Mohammed
Trim

1. What is the equation of the line passing through the point $(1, -3)$ and having slope -4 ?
- (a) $4y - x = 7$ (b) $4x + y = 7$ (c) $y - 4x + 7 = 0$ (d) $4x + y = 1$ (e) None of these

2. Which of the following augmented matrices is in reduced row echelon form?

(i) $\left(\begin{array}{ccc|c} 1 & 2 & 0 & 2 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 0 \end{array}\right)$

(ii) $\left(\begin{array}{ccc|c} 1 & 0 & 3 & 3 \\ 0 & 1 & 0 & 2 \\ 1 & 0 & 0 & -3 \end{array}\right)$

- (a) only (i) (b) only (ii) (c) both (i) and (ii) (d) neither (i) nor (ii)

3. You are told that the inverse of the matrix $A = \begin{pmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \\ -2 & 1 & 2 \end{pmatrix}$ is $A^{-1} = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & x \\ 1 & 0 & 1 \end{pmatrix}$.

What is the value of x ?

- (a) 3 (b) 0 (c) 2 (d) -1 (e) None of these

4. If the following matrix represents the augmented matrix of a system of linear equations, how many solutions does the system have?

$$\left(\begin{array}{ccc|c} 1 & 2 & 3 & 5 \\ 0 & 1 & 1 & 4 \\ 0 & 1 & 2 & 9 \\ 0 & 2 & 4 & 18 \end{array}\right)$$

- (a) one (b) two (c) none (d) infinitely many (e) None of these

5. If $A = \begin{pmatrix} 2 & 1 \\ 3 & -1 \\ -2 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 3 \\ 0 & -2 \\ 6 & 5 \end{pmatrix}$, what is the $(2, 2)$ entry of $2AB^T - 3I$, where I is the 3×3 identity matrix?

- (a) -7 (b) 1 (c) 0 (d) 7 (e) None of these

6. Which entry in the augmented matrix $\left(\begin{array}{cccc|c} 1 & 2 & 0 & -1 & 2 \\ 0 & 0 & 1 & 0 & -3 \\ 0 & 0 & 0 & 1 & 4 \end{array}\right)$ prevents it from being in REF?

- (a) the 2 in position $(1, 2)$
(b) the 0 in position $(2, 4)$
(c) the 4 in position $(3, 5)$
(d) something else
(e) the matrix is in row echelon form

7. If the matrix to the right is simplified to row echelon form, how many leading 1's will it have?

$$\begin{pmatrix} 1 & 3 & 0 & 3 & 2 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 2 & 9 \end{pmatrix}$$

- (a) 1 (b) 2 (c) 3 (d) 4 (e) None of these

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 3 of 9

TIME: 2 hours

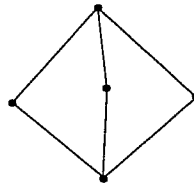
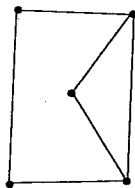
EXAMINER: Borgersen, Mohammed
Trim

8. You are given that the reduced row echelon form for the augmented matrix associated with the system of equations

$$\begin{array}{rcl} x - 2y - 4z & = & 11 \\ x - y - 2z & = & 7 \\ 3x - 4y - 8z & = & 25 \end{array} \quad \text{is} \quad \left(\begin{array}{ccc|c} 1 & 0 & 0 & 3 \\ 0 & 1 & 2 & -4 \\ 0 & 0 & 0 & 0 \end{array} \right).$$

The solution of the system is:

- (a) $x = 3, y = -4, z = 0$
 - (b) $x = 3z, y = -2z - 4$, where z is arbitrary
 - (c) $x = 3, y = -2z - 4$, where z is arbitrary
 - (d) the system does not have a solution
 - (e) none of the above
9. The following graphs are
- (a) not equivalent because they do not have the same number of nodes
 - (b) not equivalent because they do not have the same number of edges
 - (c) not equivalent because they do not have the same degree sets
 - (d) not equivalent for some other reason
 - (e) equivalent.



10. A graph has 12 edges and 8 nodes. Four nodes are known to have degree 3, and two nodes have degree 4. If the remaining nodes all have the same degree, what is this degree?

- (a) 1 (b) 2 (c) 3 (d) 4 (e) None of these

11. The adjacency matrix for a graph with 4 nodes is $A = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 2 \\ 1 & 0 & 2 & 0 \end{pmatrix}$.

What is the degree of node 3?

- (a) 2 (b) 4 (c) 6 (d) 8 (e) None of these

12. An investment of \$500 receives simple interest at a rate of 4%. What is the total value of the investment including interest earned after 6 years and 6 months?

- (a) \$648.18 (b) \$630.00 (c) \$30.00 (d) None of these

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 4 of 9

TIME: 2 hours

EXAMINER: Borgersen, Mohammed
Trim

16 13. A linear programming problem is to minimize the function $z = 3x + 2y$ subject to the constraints

$$\begin{aligned}x + y &\geq 8, \\5x + 12y &\geq 60, \\x &\geq 0, \\y &\geq 0.\end{aligned}$$

- (a) Sketch the feasible set.
- (b) Determine all corners for the feasible set.
- (c) Find the optimal solution for the problem.

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 5 of 9

TIME: 2 hours

EXAMINER: Borgersen, Mohammed
Trim

- 10 14. The Maple Leaf Company manufactures one-ton, two-ton, and four-ton trucks at two manufacturing plants, Plant A and Plant B. The number of trucks produced by each plant per week and weekly production costs for each plant are given in the following table.

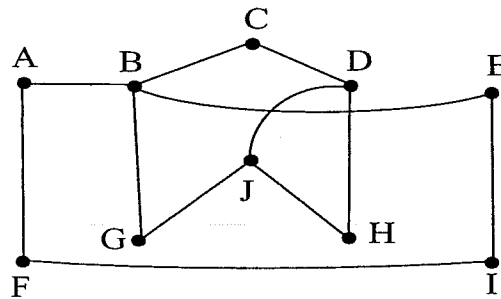
	Plant A	Plant B
One-ton trucks/week	100	50
Two-ton trucks/week	75	100
Four-ton trucks/week	50	150
Weekly cost	\$4,000,000	\$6,000,000

The company has an order to deliver 5000 one-ton trucks, 7500 two-ton trucks and 6000 four-ton trucks. Set up, **BUT DO NOT SOLVE**, a linear programming problem to determine the number of weeks each plant should operate in order to produce at least the required number of trucks at minimum cost. Your solution should contain the objective function and all constraints on all variables.

EXAMINATION: Applied Finite Mathematics

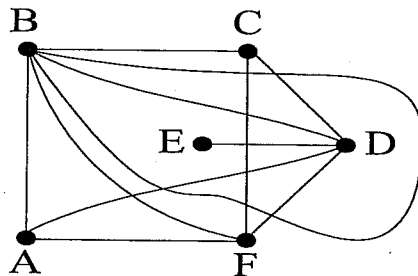
EXAMINER: Borgersen, Mohammed
Trim

15 15. Consider the following graph.



- (ii) An Euler path that is not an Euler circuit.

10 16. Consider the following graph.



(a) If the graph has Hamiltonian circuits, find one. If it does not, explain why not.

(b) What is the adjacency matrix for the graph?

(c) Use the adjacency matrix to determine the number of routes of length 2 from node B to node A. Show your work.

December 18, 2009 (Evening)
PAPER NO: 508
DEPARTMENT & COURSE NO: MATH 1010
EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION
PAGE NO: 8 of 9
TIME: 2 hours
EXAMINER: Borgersen, Mohammed
Trim

You may use the following formulas for the remaining questions.

$$S_n = P \left(1 + \frac{in}{100m} \right)$$

$$C_n = P \left(1 + \frac{i}{100m} \right)^n$$

$$A_n = \frac{P \left[\left(1 + \frac{i}{100m} \right)^n - 1 \right]}{\frac{i}{100m}}$$

- 11 17. (a) An investment of \$ P earned interest at the rate of 4% compounded quarterly. If the investment grew to \$15,000 in $10\frac{1}{2}$ years, how much was P ?

- (b) Beginning May 1, 2009, you make 60 equal monthly payments of \$100 into an account that earns 3% interest, compounded monthly. How much is in the account May 1, 2014?

THE UNIVERSITY OF MANITOBA

December 18, 2009 (Evening)

PAPER NO: 508

DEPARTMENT & COURSE NO: MATH 1010

EXAMINATION: Applied Finite Mathematics

FINAL EXAMINATION

PAGE NO: 9 of 9

TIME: 2 hours

**EXAMINER: Borgersen, Mohammed
Trim**

14 18. (a) Calculate the monthly payments on a 20-year mortgage of \$200,000 at 5% compounded monthly.

(b) How much remains to be paid on the mortgage in part (c) immediately after making the 60th payment?

