

CONCORDIA UNIVERSITY  
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/2	All except EC	
Examination	Date	Time	Pages
Final	December 2014	3 Hours	3
Instructors	Course Examiner		
A. Bellahnid, C. Santana, D. Barrera, F. Romanelli, H. Greenspan, I. Gorelyshev, L. Dube, L. Eunghyun, S. Zaman, U. Tiwari	D. Sen		

**FORMULAE:**

$$A = P(1+i)^n, \quad A = Pe^{rt}, \quad FV = PMT \frac{(1+i)^n - 1}{i}, \quad PV = PMT \frac{1 - (1+i)^{-n}}{i}$$

**Special Instructions:**

- ▷ Answer all questions.
- ▷ Only approved calculators are allowed.

**MARKS**

- [10] 1. A firm producing poultry feed finds that the total cost  $C(x)$  in dollars of producing and selling  $x$  units is given by

$$C(x) = 20x + 100.$$

Management plans to charge \$24 per unit for the feed.

- (A) How many units must be sold for the firm to break even?
  - (B) For what values of  $x$  will a loss occur? A profit?
  - (C) What is the profit if 100 units of feed are sold?
  - (D) How many units must be sold to produce a profit of \$900?
- [10] 2. Solve for  $x$  in the following equations:
- (A)  $9^{-x+15} = 27^x$
  - (B)  $(e)^{-3x^2+15x-72} = (e)^{-x^2+35x-22}$
  - (C)  $\log_7 \left( \frac{x}{5} \right) + \log_7 625 + 2 \log_7 \sqrt{5} = 3 \log_7 \sqrt[3]{7} + 4 \log_7 5$
  - (D)  $\log_5(x+6) + \log_5(x+2) = 1$
  - (E)  $\log_3 \sqrt{(x-2)} = 2$

- [10] 3. For  $f(x) = 180 - 30x$  and  $g(x) = 5^{x-5}$  find the following by only using a proper formula:

(A) 
$$\sum_{k=1}^{50} f(k) = f(1) + f(2) + f(3) + \cdots + f(50).$$

(B) 
$$\sum_{h=0}^{29} g(h) = g(0) + g(1) + g(2) + \cdots + g(29).$$

- [10] 4. A man deposits \$2,000 in an IRA on his 21st birthday and on each subsequent birthday up to, and including, his 29th. The account earns 8% compounded annually.

(A) If he leaves the money in the account without making any more deposits, how much will he have on his 65th birthday, assuming the account continues to earn the same rate of interest?

(B) How much would be in the account on his 65th birthday if he had started the deposits on his 30th birthday and continued making deposits on each birthday until (and including) his 65th birthday?

- [10] 5. Consider a \$21,281.27 loan for 7 years at 8% interest compounded quarterly and a payment of \$1000 per quarter-year.

(A) Compute the unpaid balance after 5 years.

(B) How much interest is paid during the fifth year?

(C) How much principal is repaid in the first payment?

(D) What is the total amount of interest paid on the loan?

- [10] 6. A company that rents small moving trucks wants to purchase 16 trucks with a combined capacity of 19,200 cubic feet. Three different types of trucks are available: a cargo van with a capacity of 300 cubic feet, a 15-foot truck with a capacity of 900 cubic feet, and a 24-foot truck with a capacity of 1,500 cubic feet.

(A) Write the linear system of equations in terms of  $x$ ,  $y$  and  $z$ ;  $x$ ,  $y$  and  $z$  being the number of a cargo vans, 15-foot trucks, and 24-foot trucks respectively.

(B) Solve this system of equations.

(C) The rental company charges \$24.95 per day for a cargo van, \$39.95 per day for a 15-foot truck, and \$49.95 per day for a 24-foot truck. Which of the solutions would produce the lowest daily income from the truck rentals?

- [10] 7. An economy is based on three sectors, coal, oil, and transportation. Production of a dollar's worth of coal requires an input of \$0.20 from the coal sector and \$0.40 from the transportation sector. Production of a dollar's worth of oil requires an input of \$0.10 from the oil sector and \$0.20 from the transportation sector. Production of a dollar's worth of transportation requires an input of \$0.40 from the coal sector, \$0.20 from the oil sector, and \$0.20 from the transportation sector.
- (A) Write the technological matrix  $M$  for this economy.
- (B) If a final demand of \$20 billion for coal, \$5 billion for oil, and \$10 billion for transportation is to be met, set up the equations to be satisfied by the inputs from the respective sectors.
- (C) Solve for the respective inputs satisfying these demands.
- [10] 8. Extremize  $P(x, y) = 50x + 150y$  subject to
- $$6x + 3y \geq 48, \quad 5x + 5y \geq 60, \quad 3x + 6y \geq 42, \quad x \geq 0, \quad y \geq 0.$$
- [10] 9. A corporation plans to fill 2 different positions for vice-president,  $V_1$  and  $V_2$ , from administrative officers in 2 of its manufacturing plants. Plant A has 6 officers and plant B has 8 officers.
- (A) How many ways can these 2 positions be filled if the  $V_1$  position is to be filled from plant A and the  $V_2$  position from plant B?
- (B) How many ways can the 2 positions be filled if the selection is made without regard to plant?
- [10] 10. A shipment of 40 Mickey Mouse watches contains 6 defective ones. The quality control department selects seven of these watches for testing, and rejects the entire shipment if one or more are defective.
- (A) What is the probability that the entire shipment shall be accepted?
- (B) What is the probability that the entire shipment shall be rejected?

COPYRIGHT

*The present document and the contents thereof are the property and copyright of the professor(s) who prepared this exam at Concordia University. No part of the present document may be used for any purpose other than research or teaching purposes at Concordia University. Furthermore, no part of the present document may be sold, reproduced, republished or re-disseminated in any manner or form without the prior written permission of its owner and copyright holder.*

<b>Course</b> Mathematics	<b>Number</b> 208/1	<b>Section</b> All	
<b>Examination</b> Final	<b>Date</b> Summer 2014	<b>Time</b> 3 Hours	<b>Pages</b> 3
<b>Instructors</b> Dube, Tiwari		<b>Course Coordinator</b> Cummins	
<b>Materials Allowed:</b>	Approved Calculators allowed.		
<b>Special Instructions:</b>	Answer all questions and justify your answers.		
<b>Formulas:</b>	$A = P(1+i)^n$ , $A = Pe^{rt}$ , $FV = PMT \frac{(1+i)^n - 1}{i}$ , $PV = PMT \frac{1 - (1+i)^{-n}}{i}$		

**Q1 (10 Marks)** For the quadratic function  $u(x) = 0.5x^2 + 2x - 6$

- Find the vertex form of  $u$ .
- Find the  $x$  and  $y$  intercepts algebraically.
- Find the maximum or minimum of  $u$ .
- Find the vertex of  $u$ .
- Find the range of  $u$ .

**Q2 (10 Marks)** Solve, if possible, the following equations for  $x$ . If no solution exists, explain why there is no solution.

a)

$$\left(\frac{5}{3}\right)^x = \frac{9}{25}$$

b)

$$25^{2x} - 5^{x^2-12} = 0$$

c)

$$(3^{-2x})(3^{x^2}) = 3^{-1}$$

d)

$$\log_2(x) - \log_2(x+1) = 1$$

e)

$$\log_3(x^2 + x + 3) = 2$$

**Q3 (10 Marks)** For  $f(x) = 10x - 20$  and  $g(x) = 2^{x-1}$ , find the following

a)

$$\sum_{k=2}^{39} f(k) = f(2) + f(3) + \dots + f(39)$$

b)

$$\sum_{h=4}^{21} g(h) = g(4) + g(5) + \dots + g(21)$$

**Q4 (10 Marks)**

a) Solve the following linear system using Gauss-Jordan elimination:

$$5x = 3y - 13z + 6$$

$$5x = 3y - 7z + 12$$

$$3x = 2y - 3z + 9$$

b) Check your solution to part a by substituting it into the linear system and verifying that it solves the linear system.

**Q5 (10 Marks)** You deposit \$3,000 into your RRSP account on your 25th birthday and on each subsequent birthday up to, and including, your 34th birthday. The account earns 4.5% compounded annually.

- a) If you leave the money in the account without making any more deposits, how much money will be in the account on your 65th birthday assuming the account earns the same rate of interest?
- b) How much money would be in the account on your 65th birthday if you had started the deposits of \$3,000 on your 40th birthday and continued to make deposits on each birthday up to, and including, your 65th birthday, assuming the account earns the same rate of interest?

**Q6 (10 Marks)** A family has a 30-year mortgage for \$220,000 at 6% compounding monthly.

- a) Find the monthly payment.
- b) Find the unpaid balance after 10 years.
- c) Find the total amount of interest paid on the mortgage.

**Q7 (10 Marks)** Extremize the function  $P(x, y) = 20x + 12y$  subject to the constraints:

$$3x + 2y \leq 10$$

$$5x - 4y \leq 2$$

$$x \geq 0$$

$$y > 1$$

**Q8 (10 Marks)** An economy is based on three sectors: agriculture, energy and manufacturing. Production of a dollar's worth of agriculture requires an input of \$0.18 from the agriculture sector, \$0.30 from the energy sector and \$0.10 from the manufacturing sector. Production of a dollar's worth of energy requires an input of \$0.25 from the energy sector and \$0.30 from the manufacturing sector. Production of a dollar's worth of manufacturing requires an input of \$0.12 from the agriculture sector, \$0.10 from the energy sector and \$0.25 from the manufacturing sector.

- a) Find the technology matrix  $M$  for this economy.
- b) If a final demand of \$25 billion for agriculture, \$15 billion for energy and \$30 billion for manufacturing is to be met, then set up the equation to be satisfied by the inputs from the respective sectors.
- c) Solve for the respective inputs satisfying these demands.

**Q9 (10 Marks)** A group of 100 people is divided into 2 teams with 45 people in team A and 55 people in team B.

- a) If 20 of the people are mathematicians and 80 are non-mathematicians, in how many ways can the teams be formed if all the mathematicians are in team A?
- b) In how many ways can the teams be formed if none of the mathematicians are in team A?

**Q10 (10 Marks)** A research company does a survey involving 18 manufacturers of motor vehicles. The result of the survey will be a ranking of the manufacturers from most popular to least popular.

- a) If no companies are equally ranked, what is the total number of possible outcomes of the survey?
- b) If one of the companies is the Acme Car Company and another is the Low Quality Car Company, how many possible outcomes of the survey have the Acme Car Company ranked as the most popular and the Low Quality Car Company as the least popular? As in part a, assume that no companies are equally ranked.

<b>Course</b> Mathematics	<b>Number</b> 208/4	<b>Section</b> All except EC	
<b>Examination</b> Final	<b>Date</b> April 2014	<b>Time</b> 3 Hours	<b>Pages</b> 3
<b>Instructors</b> Dube, Hughes, Kalvin, Kokotov, Romanelli, White		<b>Course Coordinator</b> Cummins	
<b>Materials Allowed:</b>		Approved Calculators allowed.	
<b>Special Instructions:</b>		Answer all questions and justify your answers.	
<b>Formulas:</b> $A = P(1+i)^n$ , $A = Pe^{rt}$ , $FV = PMT \frac{(1+i)^n - 1}{i}$ , $PV = PMT \frac{1 - (1+i)^{-n}}{i}$			

**Q1 (10 Marks)** A manufacturer of tablet computers, after extensive research, established the following price-demand, and cost functions:

$$p(x) = 360 - 20x$$

$$C(x) = 300 + 95x$$

where  $p(x)$  is the wholesale price in dollars at which  $x$  million tablet computers can be sold. The cost  $C(x)$  is in millions of dollars. The domain of each function is  $1 \leq x \leq 15$ .

- Find the revenue function  $R(x)$  and sketch the graph of  $R(x)$ .
- Find the output which will produce the maximum revenue. What is the maximum revenue? What is the wholesale price, per tablet computer, that produces the maximum revenue?
- For what outputs will a loss occur? For what outputs will a profit occur?

**Q2 (10 Marks)** Solve the following equations for  $x$ .

a)  $x^2 - x = \log_2(4)$

b)  $36^{2x} - 6^{x^2-12} = 0$

c)  $2 \log_3(x+1) - 2 \log_3(9) = 2$

d)  $\log_8(x-1) + \log_8(x+1) = 1$

e)  $\log_{10}(x+7) - \log_{10}(x-2) = 1$

**Q3 (10 Marks)**

- a) An arithmetic sequence has 100 terms. If the 100th term is 1000 and the sum of all 100 terms is 50000, what is the first term?
- b) If  $h(n) = 10(0.9)^n$ , compute the sum

$$\sum_{n=2}^{20} h(n) = h(2) + h(3) + \dots + h(20)$$

**Q4 (10 Marks)**

- a) Solve the following linear system using Gauss-Jordan elimination:

$$3x + 6y = -9z + 3$$

$$2x + 3y = -4z + 3$$

$$3x + 6y = -3z + 9$$

- b) Check your solution to part a by substituting it into the linear system and verifying that it solves the linear system.

**Q5 (10 Marks)** A company takes out a loan for \$150000 at an interest rate of 4% compounded monthly.

- a) If the loan is due to be repaid in a single payment after 2 years, what is the total amount, including interest, which the company will have to repay?
- b) The company has insufficient funds to repay this all of this loan. So it takes a second loan of \$8000 at an interest rate of 3% compounded monthly which is paid in equal monthly installments over a period of 5 years. What is the amount of the monthly payments? What is the total amount of interest paid on the second loan?

**Q6 (10 Marks)**

- a) You invest \$5000 at the end of each of 30 years into an account that earns 8% compounded annually. How much money is in the account at the end of this time?
- b) You then use this money to purchase an annuity which pays equal monthly amounts for 10 years at a rate of 6% compounded monthly. What is the amount of the monthly payments?

**Q7 (10 Marks)** Extremize the function  $P(x, y) = 10x + 12y$  subject to the constraints:

$$2x + 3y \leq 12$$

$$4x - 5y \leq 2$$

$$x \geq 1$$

$$y \geq 1$$

**Q8 (10 Marks)** A family has a \$130000, 25 year mortgage at 4.2% compounding monthly.

- a) Find the monthly payment.
- b) Find the unpaid balance after 15 years.
- c) Find the total amount of interest paid on the mortgage.

**Q9 (10 Marks)** A car rental company has 4 red cars and 5 blue cars.

- a) In how many ways can a fleet of 3 cars be selected.
- b) If the fleet of 3 cars is selected at random, what is the probability that all the cars are blue?
- c) If the fleet of 3 cars is selected at random, what is the probability that 1 is blue and the other 2 are red?

**Q10 (10 Marks)** The board of directors of a company consists of 6 women and 4 men.

- a) If the Chair and Vice-Chair of the board are selected at random, what is that probability that both are women?
- b) If the members of a 3 person committee are selected at random, what is the probability that the majority of members are men?

**CONCORDIA UNIVERSITY**  
**Department of Mathematics & Statistics**

Course	Number	Section(s)	
Mathematics	208/1	All except EC	
Examination	Date	Time	Pages
Final	June 2013	3 Hours	3
Instructors	Course Examiner		
D. Sen, T. Hughes, U. Tiwari	D. Sen		

**FORMULAE:**

$$A = P(1+i)^n, \quad A = Pe^{rt}, \quad FV = PMT \frac{(1+i)^n - 1}{i}, \quad PV = PMT \frac{1 - (1+i)^{-n}}{i}$$

**Special Instructions:**

- ▷ Answer all questions.
- ▷ Only approved calculators are allowed.

**MARKS**

- [10] 1. The marketing research department for a company that manufactures and sells notebook computers established the following price-demand, revenue and cost functions:

$$\begin{aligned} p(x) &= 2,000 - 60x \\ R(x) &= x(2,000 - 60x) \\ C(x) &= 4,000 + 500x \end{aligned}$$

where  $p(x)$  is the wholesale price in dollars at which  $x$  thousand computers can be sold, and  $R(x)$ , and  $C(x)$  are in thousands of dollars. Both functions have domain  $1 \leq x \leq 25$ .

- (A) Find the output that will produce the maximum revenue. What is the maximum revenue to the nearest thousand dollars?
- (B) What is the wholesale price per computer (to the nearest dollar) that produces the maximum revenue?
- (C) Find the break-even points algebraically to the nearest thousand computers.
- [10] 2. Solve for  $x$  in the following equations:
- (A)  $(6)^{x^2+8} = (216)^{2x}$
- (B)  $e^{-x^2} = (e^x)^2 \left(\frac{1}{e^3}\right)$
- (C)  $\log_2(8)^x = -3$
- (D)  $\log_a x + \log_a(x-4) = \log_a(x+6)$
- (E)  $\log_{\frac{1}{3}}(x^2+x) - \log_{\frac{1}{3}}(x^2-x) = -1$

[10] 3. For  $f(x) = -166x + 58$  and  $g(x) = 6(0.5)^x$ , find the following:

$$(A) \sum_{k=0}^{49} f(k) = f(0) + f(1) + f(2) + \cdots + f(49)$$

$$(B) \sum_{h=1}^{30} g(h) = g(1) + g(1) + g(2) + \cdots + g(30)$$

[10] 4. Sandra, a 25-year old professional, puts \$750 in a retirement fund at the end of each quarter until her reaches age 60. The account pays 8% interest compounded quarterly.

(A) How much will be in the account when Sandra is 60?

(B) If Mary makes no further deposits after age 60, how much will she have for retirement at age 65?

[10] 5. A person purchased a \$200,000 home 20 years ago by paying 20% down and signing a 30-year mortgage at 13.2% compounded monthly.

(A) Find the monthly payment? How much interest was paid during the first 20 years?

(B) The owner wants to refinance the home for interest rates have dropped. Now the owner refinance the unpaid balance by signing a new 10-year mortgage at 8.2% compounded monthly. How much interest will refinancing save?

[10] 6. Solve by using Gauss-Jordan Elimination:

$$3x_1 + 5x_2 - x_3 = -7$$

$$x_1 + x_2 + x_3 = -1$$

$$2x_1 + 11x_3 = 7$$

**No other method of solving these systems of equations will be accepted!**

- [10] 7. An economy is based on the three sectors: agriculture, energy and manufacturing. Production of one dollar's worth of agriculture requires an input of \$0.20 from agriculture and \$0.40 from energy. Production of one dollar's worth of energy requires an input of \$0.10 from energy and \$0.20 from manufacturing. Production of one dollar's worth of manufacturing requires an input of \$0.40 from agriculture, \$0.20 from energy and \$0.20 from manufacturing.
- (A) Write the technological matrix  $M$  for this economy.
- (B) If a final demand of \$30 billion for agriculture, \$10 billion for energy, and \$20 billion for manufacturing is to be met, then set up the equation to be satisfied by the inputs from the respective sectors.
- (C) Solve the respective inputs satisfying these demands.
- [10] 8. Extremize  $P(x, y) = 20x + 30y$  subject to
- $$2x + y \leq 20, \quad 10x + y \geq 36, \quad 2x + 5y \geq 36, \quad x \geq 0, \quad y \geq 0.$$
- [10] 9. The 14 colleges of interest to a high school senior include 6 that are expensive (tuition more than \$20,000 per year), 7 that are far from home (more than 200 miles away), and 2 that are both expensive and far from home.
- (A) If the student decides to select a college that is not expensive and within 200 miles of home, how many selections are possible?
- (B) If the student decides to attend a college that is not expensive and within 200 miles from home during his first two years of college, and then will transfer to a college that is not expensive but is far from home, how many selections of two colleges are possible?
- [10] 10. A large computer company  $A$  subcontracts the manufacturing of its circuit boards to two companies: 40% to company  $B$  and 60% to company  $C$ . Company  $B$  in turn subcontracts 70% of the orders it receives from company  $A$  to company  $D$  and the remaining 30% to company  $E$ , both subsidiaries of company  $B$ . When the boards are completed by companies  $D$ ,  $E$ , and  $C$ , they are shipped to company  $A$  to be used in various computer models. It has been found that 1.5%, 1%, and 0.5% of the boards from  $D$ ,  $E$ , and  $C$ , respectively, prove defective during the 3 year warranty period after a computer is first sold.
- (A) What is the probability that a given board in a computer will be defective during the 3 year warranty period?
- (B) What is the probability that a circuit board in a completed computer came from company  $E$  or  $C$ ?