

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/4	All	
Examination	Date	Time	Pages
Alternate Midterm	February 2012	1 Hour 30 minutes	2
Instructors		Course Examiner	
C. Cummins, E. Smith, L. Dube, P. Eslami, T. Zaihra, 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 and revenue functions:

$$p(x) = 2,000 - 60x$$
$$R(x) = x(2,000 - 60x)$$

where $p(x)$ is the wholesale price in dollars at which x thousand computers can be sold, and $R(x)$ is 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?

- [10] 2. Solve for x in the following equations:

(A) $3^{5x-x^2} = \frac{1}{729}$

(B) $\log_3(6x - 2) = 2$

(C) $\log_a x + \log_a(x + 1) = \log_a(6)$

(D) $\log_b x = \frac{2}{3} \log_b 27 + 2 \log_b 2 - \log_b 3$

PLEASE TURN OVER

- [10] 3. A person borrows \$6,000 and agrees to repay the loan in monthly installments over a period of 5 years. The agreement is to pay 1% of the unpaid balance each month for using the money and \$100 each month to reduce the loan. What is the total cost of the loan over the 5 years?
- [10] 4. George finds a company that charges 0.59\$ per day for each \$1,000 borrowed. If he borrows \$3,000 for 60 days, what amount will he repay, and what annual interest rate will he be paying the company?
- [10] 5. Barbara deposits \$2,000 annually into a Roth IRA that earns 6.85% compounded annually. (The interest earned by a Roth IRA is tax free.) Due to a change in employment, these deposits stop after 10 years, but the account continues to earn interest until Barbara retires 25 years after the last deposit was made.
- (A) How much is in the account when Barbara retires?
- (B) Mary starts a Roth IRA earning the same rate of interest at the time Barbara stops making payments into her IRA. How much must Mary deposit each year for the next 25 years in order to have the same amount at retirement as Barbara has?
- [10] 6. A family takes out a mortgage to pay for a \$200,000 house. The nominal annual interest rate is 6% compounded monthly. The mortgage is amortized over 25 years.
- (A) What are the monthly payments?
- (B) The family pays the monthly payments for 10 years. At the end of these 10 years, calculate the remaining balance on the mortgage.
- (C) How much did the family pay in total during these 10 years? How much of this was interest?

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

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Course	Number	Section(s)	
Mathematics	208/4	All except EC	
Examination	Date	Time	Pages
Final	April 2011	3 Hours	3
Instructors		Course Examiner	
A. Madjid, C. Cummins, C. Santana, E. Smith, R. Mearns, T. Hughes, T. Koulis		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 functions and cost functions:

$$p(x) = 2,000 - 60x$$

$$R(x) = x(2,000 - 60x)$$

$$C(x) = 4,000 + 500x$$

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. The functions $R(x)$ and $C(x)$ have domain $1 \leq x \leq 25$.

- (A) What is the wholesale price per computer (to the nearest dollar) that produces the maximum revenue?
 - (B) Find the break-even points.
 - (C) For what values of x will a loss occur? A profit?
- [10] 2. Solve for x in the following equations:
- (A) $e^{12} = (e^4)^x e^{x^2}$
 - (B) $(27)^{2x} = (3)^{x^2-7}$
 - (C) $\log_b x = \frac{3}{2} \log_b 4 - \frac{2}{3} \log_b 8 + 2 \log_b 2$
 - (D) $\log_a x + \log_a (x-4) = \log_a (21)$
 - (E) $\log_8 (x+6) = 1 - \log_8 (x+4)$

[10] 3. For $f(x) = 18 - 3x$ and $g(x) = 4^{x-4}$ find the following:

$$(A) \sum_{k=1}^{60} f(k) = f(1) + f(2) + f(3) + \cdots + f(60).$$

$$(B) \sum_{h=0}^{30} g(h) = g(0) + g(1) + g(2) + \cdots + g(30).$$

[10] 4. Beginning in January, a person plans to deposit \$100 at the end of each month into an account earning 6% compounded monthly. Each year taxes must be paid on the interest earned during that year. Find the interest earned during each year for the first 3 years.

[10] 5. A family has a \$129,000, 20-year mortgage at 7.2% compounded monthly.

(A) Find the monthly payment and the total interest paid during the entire life of the mortgage.

(B) Suppose the family decides to add an extra \$102.41 to its mortgage payment each month starting with the very first payment. How long will it take the family to pay off the mortgage?

(C) How much interest will be saved after adding the extra \$102.41?

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

$$3x_1 + 8x_2 - x_3 = -18$$

$$2x_1 + x_2 + 5x_3 = 8$$

$$2x_1 + 4x_2 + 2x_3 = -4$$

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

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- [10] 7. An economy is based on three sectors, agriculture, manufacturing, and energy. Production of a dollar's worth of agriculture requires an input of \$0.20 from agriculture, \$0.20 from manufacturing, and \$0.20 from energy. Production of a dollar's worth of manufacturing requires an input of \$0.40 from agriculture, \$0.10 from manufacturing, and \$0.10 from energy. Production of a dollar's worth of energy requires an input of \$0.30 from agriculture, \$0.10 from manufacturing, and \$0.10 from energy.
- (A) Write the technological matrix M for this economy.
- (B) If a final demand of \$10 billion for agriculture, \$20 billion for manufacturing, and \$15 billion for energy 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 $P(x, y) = 60x + 20y$ subject to
- $$2x + 2y \geq 4, \quad 6x + 4y \leq 36, \quad 2x + y \leq 10, \quad x \geq 0, \quad y \geq 0.$$
- [10] 9. A county park system rates its 20 golf courses in increasing order of difficulty as bronze, silver, or gold. There are only two gold courses and twice as many bronze as silver courses.
- (A) If a golfer decides to play a round at a silver or gold course, how many selections are possible?
- (B) If a golfer decides to play one round per week for 3 weeks, first on a bronze course, then silver, then gold, how many combined selections are possible?
- [10] 10. If each of 5 people is asked to identify his or her favorite book from a list of 10 best-sellers, what is the probability that at least 2 of them identify the same book?

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CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/2	All except EC	
Examination	Date	Time	Pages
Final	December 2010	3 Hours	3
Instructors		Course Examiner	
A. Kokotov, B. Rhodes, E. Duma, E. Smith, J. McSweeney, J. Ruddy, R. Perez-Buendia, T. Koulis, 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. Given the quadratic function $f(x) = -0.15x^2 - 0.90x + 3.3$

- (A) Find x and y intercepts algebraically.
- (B) Find the vertex form of f .
- (C) Find the vertex and the maximum or minimum.
- (D) Find the range of f .

[10] 2. Solve for x in the following equations:

- (A) $4^{x^2-4x} = \frac{1}{256}$
- (B) $(100)^{2x} = (10)^{x^2-12}$
- (C) $3\log_2(x-1) + \log_2 4 = 5$
- (D) $\log_a x + \log_a(x-4) = \log_a(x+6)$
- (E) $\log_3(4x-7) = 2$

[10] 3. For $f(x) = 24 - 6x$ and $g(x) = 5^{x-5}$ find the following:

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

(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. On December 31, 1990, a house was purchased with the buyer taking out a 30 year, \$112,475 mortgage at 9% interest, compounded monthly. The mortgage payments are made at the end of each month.

(A) Calculate the amount of the monthly payment.

(B) Calculate the unpaid balance of the loan on December 31, 2016.

(C) How much of the principal will be paid off during the year 2016?

(D) How much interest will be paid during the year 2016?

[10] 6. A company that rents small moving trucks wants to purchase 25 trucks with a combined capacity of 28,000 cubic feet. Three different types of trucks are available: a 10-foot truck with a capacity of 350 cubic feet, a 14-foot truck with a capacity of 700 cubic feet, and a 24-foot truck with a capacity of 1,400 cubic feet.

(A) Write the linear system of equations in terms of x , y and z ; x , y and z being the number of 10-foot trucks, 14-foot trucks, and 24-foot trucks respectively.

(B) Solve this system of equations.

(C) The rental company charges \$19.95 per day for a 10-foot truck, \$29.95 per day for a 14-foot truck, and \$39.95 per day for a 24-foot truck. Which of the solutions would produce the largest daily income from the truck rentals?

- [10] 7. An economy is based on three sectors, agriculture, manufacturing, and energy. Production of a dollar's worth of agriculture requires an input of \$0.20 from agriculture, \$0.20 from manufacturing, and \$0.20 from energy. Production of a dollar's worth of manufacturing requires an input of \$0.40 from agriculture, \$0.10 from manufacturing, and \$0.10 from energy. Production of a dollar's worth of energy requires an input of \$0.30 from agriculture, \$0.10 from manufacturing, and \$0.10 from energy.

- (A) Write the technological matrix M for this economy.
- (B) If a final demand of \$10 billion for agriculture, \$15 billion for manufacturing, and \$20 billion for energy 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 $P(x, y) = 40x + 20y$ subject to

$$6x + 9y \geq 90, \quad 2x + y \leq 26, \quad -2x + 5y \leq 34, \quad x \geq 0, \quad y \geq 0.$$

- [10] 9. A software development department consists of 6 women and 4 men.

- (A) How many ways can the department select a chief programmer, a backup programmer, and a programming librarian?
- (B) How many of the selections in part (A) consist entirely of women?
- (C) How many ways can the department select a team of 3 programmers to work on a particular project?

- [10] 10. Six popular brands of cola are to be used in a blind taste study for consumer recognition.

- (A) If 3 distinct brands are chosen at random from the 6 and if a consumer is not allowed to repeat any answers, what is the probability that all 3 brands could be identified by just guessing?
- (B) If repeats are allowed in the 3 brands chosen at random from the 6 and if a consumer is allowed to repeat answers, what is the probability that all 3 brands are identified correctly by just guessing?

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/4	All	
Examination	Date	Time	Pages
Final	April 2010	3 Hours	3
Instructors		Course Examiner	
B. Rhodes, L. Dube, P. Eslami, R. Gaba, T. Koulis		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. Given the quadratic function $f(x) = -0.12x^2 + 0.96x + 1.2$

- (A) Find x and y intercepts algebraically.
- (B) Find the vertex form of f .
- (C) Find the vertex and the maximum or minimum.
- (D) Find the range of f .

[10] 2. Solve for x in the following equations:

(A) $e^{2x} = e^{x^2-3}$

(B) $2^{3x} = \frac{1}{8}$

(C) $\log_{10}(2x-5) - \log_{10}(x-3) = 1$

(D) $\log_b(x+2) + \log_b(x) = \log_b 24$

(E) $\log_3(9x) - \log_3(x-8) = 4$

- [10] 3. For $f(x) = -20x + 15$ and $g(x) = 3(1.8)^x$ find the following:

(A) $\sum_{k=0}^{29} f(k) = f(0) + f(1) + f(2) + \cdots + f(29).$

(B) $\sum_{h=0}^{19} g(h) = g(0) + g(1) + g(2) + \cdots + g(19).$

- [10] 4. Earl and Larry each begin full-time jobs in January 2009 and plan to retire in January 2057 after working for 48 years. Assume that any money they deposit into IRAs earns 6% interest compounded annually.

- (A) Suppose Earl opens a traditional IRA account immediately and deposits \$5000 into his account at the end of each year for twelve years. After that he makes no further deposits and just lets the money earn interest. How much money will Earl have in his account when he retires in January 2057?
- (B) Suppose Larry waits 12 years before opening his traditional IRA and then deposits \$5000 into the account at the end of each year until he retires. How much money will Larry have in his account when he retires in January 2057?
- (C) Who had the most money in his account upon retirement?

- [10] 5. A person wants to establish an annuity for retirement purposes. He wants to make quarterly deposits for 20 years so that he can then make quarterly withdrawals of \$5,000 for 10 years. The annuity earns 7.32% interest compounded quarterly.

- (A) How much will have to be in the account at the time he retires?
- (B) How much should be deposited each quarter for 20 years in order to accumulate the required amount?
- (C) What is the total amount of interest earned during the 30 year period?

- [10] 6. A chemical manufacturer wants to lease a fleet of 24 railroad tank cars with a combined carrying capacity of 520,000 gallons. Tank cars with three different carrying capacities are available: 8,000 gallons, 16,000 gallons, and 24,000 gallons.

- (A) Write the linear system of equations in terms of x , y and z ; x , y and z being the number of tank-cars with carrying capacities of 8,000, 16,000 and 24,000 gallons respectively.
- (B) Solve this system of equations.
- (C) If the cost of leasing an 8,000 gallon tank car is \$450 per month, a 16,000 gallon tank car is \$650 per month, and a 24,000 gallon tank car is \$1,150 per month, then which of the solutions would minimize the monthly leasing cost?

- [10] 7. A large energy company produces electricity, natural gas, and oil. The production of a dollar's worth of electricity requires an input of \$0.30 from electricity, \$0.10 from natural gas, and \$0.20 from oil. Production of a dollar's worth of natural gas requires an input of \$0.30 from electricity, \$0.10 from natural gas, and \$0.20 from oil. Production of a dollar's worth of oil requires an input of \$0.10 from each sector.

- (A) Write the technology matrix M for this economy.
- (B) If a final demand of \$25 million for electricity, \$15 million for gas, and \$20 million for oil 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 $P(x, y) = 30x + 10y$ subject to

$$2x + y \leq 20, 10x + y \geq 36, 2x + 5y \geq 36, x \geq 0, y \geq 0.$$

- [10] 9. A basketball team has 5 distinct positions. Out of 8 players, how many starting teams are possible if

- (A) The distinct positions are not taken into consideration?
- (B) The distinct positions are taken into consideration?
- (C) The distinct positions are not taken into consideration, but either Mike or Ken (but not both) must start?

- [10] 10. From a survey involving 1,000 people in a certain city, it was found that 500 people had tried a certain brand of diet cola, 600 had tried a certain brand of regular cola, and 200 had tried both types of cola. If a resident of the city is selected at random, what is the probability that

- (A) The resident has not tried either cola?
- (B) The resident has tried the diet cola or has not tried the regular cola?
- (C) The resident has tried one of the colas but not both?

CONCORDIA UNIVERSITY
Department of Mathematics & Statistics

Course	Number	Section(s)	
Mathematics	208/2	All	
Examination	Date	Time	Pages
Final	December 2009	3 Hours	3
Instructors		Course Examiner	
B. Rhodes, E. Cohen, E. Duma, F. Romanelli, H. Greenspan, L. Dube, M. Padamadan, P. Gauthier, R. Mearns, T. Hughes, V. Enolskii		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 memory chips for microcomputers established the following price-demand, revenue and cost functions:

$$\begin{aligned}p(x) &= 75 - 3x \\R(x) &= x(75 - 3x) \\C(x) &= 125 + 16x\end{aligned}$$

where $p(x)$ is the wholesale price in dollars at which x million chips can be sold, $R(x)$ and $C(x)$ are in millions of dollars. Both functions have domain $1 \leq x \leq 20$.

- (A) Find the output that will produce the maximum revenue. What is the maximum revenue?
- (B) Find the break-even points to the nearest thousands chips.
- (C) For what outputs will a loss occur?

- [10] 2. Solve for x in the following equations:

- (A) $2^{x^2-4x} = \frac{1}{16}$
- (B) $(10)^{3x^2+25x-72} = (10)^{x^2+35x-22}$
- (C) $\ln(x+2) = \ln(x-7) + \ln 4$
- (D) $\log_{10}(x-1) + \log_{10}(x+2) = 1$
- (E) $\log_3(6x-2) = 2$

- [10] 3. For $f(x) = 36 - 6x$ and $g(x) = 5(0.4)^x$ find the followings using only proper formula:

(A) $\sum_{k=1}^{30} f(k) = f(1) + f(2) + f(3) + \cdots + f(30).$

(B) $\sum_{h=1}^{20} g(h) = g(1) + g(2) + g(3) + \cdots + g(20).$

- [10] 4. A business borrows \$80,000 at 9.42% interest compounded monthly for 8 years.

- (A) What is the monthly payment?
(B) What is the unpaid balance at the end of the first year?
(C) How much interest was paid during the first year?

- [10] 5. The Beyes plan to purchase a home for \$212,000. They will pay 20% down and finance the remainder for 30 years at 7.2% interest, compounded monthly.

- (A) How large are their monthly payments?
(B) What will be their approximate loan balance right after they have made their 96th payment?
(C) How much interest will they pay during the 7th year of the loan?
(D) If they were to increase their monthly payments by \$150, how long would it take to pay off the loan?

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

$$3x_1 + 8x_2 - x_3 = -18$$

$$2x_1 + x_2 + 5x_3 = 8$$

$$2x_1 + 4x_2 + 2x_3 = -4$$

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

- [10] 7. An island economy is based on three sectors, tourism, agriculture, and fishing. Production of a dollar's worth of tourism requires an input of \$0.20 from the tourism sector and \$0.40 from the fishing sector. Production of a dollar's worth of agriculture requires an input of \$0.10 from the agriculture sector and \$0.20 from the fishing sector. Production of a dollar's worth of fishing requires an input of \$0.40 from the tourism sector, \$0.20 from the agriculture sector, and \$0.20 from the fishing sector.
- (A) Write the technological matrix M for this island economy.
- (B) If a final demand of \$30 million, \$10 million and \$20 million from tourism, agriculture and fishing 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 $P(x, y) = 30x + 10y$ subject to
- $$2x + 2y \geq 4, \quad 6x + 4y \leq 36, \quad 2x + y \leq 10, \quad x \geq 0, \quad y \geq 0.$$
- [10] 9. A survey of 1,000 people indicates that 340 have invested in stocks, 480 have invested in bonds, and 210 have invested in stocks and bonds.
- (A) How many people in the survey have invested in stocks or bonds?
- (B) How many people in the survey have invested in neither stocks nor bonds?
- (C) How many people in the survey have invested in bonds and not in stocks?
- [10] 10. To transfer into a particular technical department, a company requires an employee to pass a screening test. A maximum of 3 attempts are allowed at 6-month intervals between trials. From past record it is found that 40% pass on the first trial; of those that fail the first trial and take the test a second time, 60% pass; and of those that fail on the second trial and take the test a third time, 20% pass. For an employee wishing to transfer:
- (A) What is the probability of passing the test on the first or second try?
- (B) What is the probability of failing on all 3 attempts?
- (C) What is the probability of failing on the first 2 trials and passing on the third?

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Course	Number	Section(s)
Mathematics	208/4	All
Examination	Date	Pages
Final	April 2009	3
Instructors		Course Examiner
P. Eslami, R. Mearns, M. Padamadin, B. Rhodes		E. Cohen

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 and justify your answers.
- ▷ Only approved calculators are permitted.

MARKS

- [10] 1. A company buys a new boat for \$224,000; the boat value will be \$115,200 after 16 years.

- (a) Find a linear equation for the depreciated value V of the boat t years after it was purchased.
- (b) What is the depreciated value of the boat after 10 years?
- (c) When will the depreciated value fall below \$100,000?

- [10] 2. Solve for x in the following equations:

- (a) $13^{7x} = 13^{2x^2+3}$
- (b) $9^{2x-x^2} = 3^{-48}$
- (c) $\log_b x = 3 \log_b 2 + \frac{1}{2} \log_b 25 - \log_b 20$
- (d) $\log_b x - \log_b (x-4) = \log_b 21$
- (e) $\log_{10}(x-1) - \log_{10}(x+1) = 1$

[10] 3. (a) Find $f(1) + \dots + f(225)$ if $f(x) = 2x - 1$.

(b) Find $g(1) + \dots + g(121)$ if $g(x) = \left(\frac{1}{2}\right)^x$.

[10] 4. A company establishes a sinking fund to buy new computer equipment, with monthly payments of \$1,500, into an account paying 6% compounded monthly.

(a) How long will it be before the account has \$50,000? (Round up to the next higher month if not exact.)

(b) How much interest has been earned?

[10] 5. A family has an \$80,000, 25-year mortgage at 8.4% compounded monthly.

(a) Find the monthly payment.

(b) Find the unpaid balance after 10 years.

(c) Find the unpaid balance after 20 years.

[10] 6. Solve by using Gauss-Jordan elimination only (no other method of solving this system will be accepted).

$$4x_1 - 2x_2 + 3x_3 = 3$$

$$3x_1 - x_2 - 2x_3 = -10$$

$$2x_1 + 4x_2 - x_3 = 1$$

[10] 7. An economy is based on 3 sectors: agriculture, manufacturing and energy. Production of a dollar's worth of agriculture requires inputs of \$0.20 from agriculture, \$0.20 from manufacturing and \$0.20 from energy. Production of a dollar's worth of manufacturing requires inputs of \$0.40 from agriculture, \$0.10 from manufacturing and \$0.10 from energy. Production of a dollar's worth of energy requires inputs of \$0.30 from agriculture, \$0.10 from manufacturing and \$0.10 from energy. Find the output from each sector that is needed to satisfy a final demand of \$10 billion from agriculture, \$15 billion from manufacturing and \$20 billion from energy.

- [10] 8. Minimize and maximize $P = 20x + 10y$, subject to

$$2x + 3y \geq 30$$

$$2x + y \leq 26$$

$$-2x + 5y \leq 34$$

$$x, y \geq 0$$

- [10] 9. 6 female and 5 male applicants have been successfully screened for 5 positions. In how many ways can the following compositions be selected:

- (a) 3 females and 2 males;
- (b) 4 females and 1 male;
- (c) 5 females;
- (d) 5 people;
- (e) at least 4 females.

- [10] 10. A shipment of 60 watches, including 9 that are defective, is sent to a store. The receiving department selects 10 at random for testing and rejects the whole shipment if 1 or more in the sample are found to be defective. What is the probability that the shipment will be rejected?

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Department of Mathematics & Statistics

Course	Number	Section(s)
Mathematics	208/2	All
Examination	Date	Pages
Final	December 2008	3
Instructors		Course Examiner
E. Cohen, E. Duma, T. Howlader, T. Hughes, B. Rhodes, C. Santana, U. Tiwari, M. Tziritas, H. Yue		E. Cohen

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 plant can manufacture 50 rackets per day for a total daily cost of \$3855 and 60 rackets per day for a total daily cost of \$4245.
- (a) Assuming that daily cost and production are linearly related, find the total daily cost $C(x)$ of producing x rackets.
 - (b) Graph the total daily cost for $0 \leq x \leq 100$.
 - (c) Interpret the slope and y -intercept of this cost equation.
- [10] 2. Solve for x in the following equations:
- (a) $7^{x^2} = 7^{2x+3}$
 - (b) $4^{5x-x^2} = 2^{-12}$
 - (c) $\log_b x = \frac{3}{2} \log_b 4 - \frac{2}{3} \log_b 8 + 2 \log_b 2$
 - (d) $\log_b(x+2) + \log_b x = \log_b 24$
 - (e) $\log_{10}(x+6) - \log_{10}(x-3) = 1$

[10] 3. (a) Find $f(1) + f(2) + \dots + f(175)$ if $f(x) = 3 - 4x$

(b) Find $g(1) + g(2) + \dots + g(126)$ if $g(x) = \left(\frac{1}{3}\right)^x$

[10] 4. A company establishes a sinking fund for upgrading office equipment with monthly payments of \$2000 into an account paying 6.6% compounded monthly.

(a) How long will it be before the account has \$100000? (round up to the next higher month if not exact)

(b) How much interest has been earned?

[10] 5. A family has \$50000, 20-year mortgage at 7.2% compounded monthly.

(a) Find the monthly payment.

(b) Find the unpaid balance after 5 years.

(c) Find the unpaid balance after 15 years.

[10] 6. Solve by using Gauss-Jordan elimination only (no other method of solving this system will be accepted).

$$5x_1 - 3x_2 + 2x_3 = 13$$

$$2x_1 - x_2 - 3x_3 = 1$$

$$4x_1 - 2x_2 + 4x_3 = 12$$

[10] 7. A large company produces electricity, natural gas and oil. The production of a dollar's worth of electricity requires inputs of \$0.30 for electricity, \$0.10 from natural gas, \$0.20 from oil. Production of a dollar's worth of natural gas requires inputs of \$0.30 electricity, \$0.10 from natural gas, to \$0.20 from oil. Production of a dollar's worth of oil requires inputs of \$0.10 from each sector. Find the output for each sector that is needed to satisfy a final demand of \$25 billion for electricity, \$15 billion for natural gas, and \$20 billion for oil.

[10] 8. Minimize and maximize $P = 2x + y$ subject to

$$x + y \geq 2$$

$$6x + 4y \leq 36$$

$$4x + 2y \leq 20$$

$$x, y \geq 0$$

- [10] 9. A jewellery store chain with 8 stores in Georgia, 12 in Florida, and 10 in Alabama is planning to close 10 of these stores.
- (a) In how many ways can this be done?
 - (b) The company decides to close 2 stores in Georgia, 5 in Florida and 3 in Alabama. In how many ways can this be done?
- [10] 10. A manufacture produces 40 computer boards, including 7 that are defective. The quality control department selects 10 at random and will shut down the plant if 1 or more in the sample are found defective. What is the probability that the plant will be shut down?