Prince Sultan University
Department of Mathematical Sciences
Major II Exam A
Semester I, 2010   Fall (101)
December 11, 2010

MATH 101 – Finite Mathematics

Time Allowed   : 100 minutes
Maximum Points: 100 points

Name of the student:_____

ID number   : _____

Section   : _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your <u>mobile</u> phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. This examination has 12 problems, some with several parts and a total of 7 pages. Make sure your paper has all these problems.

Question	Maximum score	Your Score
Q.1 , Q.2	18	
Q.3 , Q.4	16	
Q.5 , Q.6 , Q.7 , Q.8	28	
Q.9 , Q.10	18	
Q.11 , Q12	20	
Total	**100**	

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_____ 1) If a linear programming problem has a solution, it is located at the center of the set of feasible points.

_____ 2) The following is a standard minimization problem:

Minimize $C = x_1 + 2x_2 + x_3$ Subject to the constraints

$$4x_1 - 3x_2 - x_3 \geq 3$$
$$x_1 + x_2 + x_3 \geq -10$$
$$2x_1 + x_2 - x_3 \geq 0$$
$$x_1 \geq 0 \ , \ x_2 \geq 0 \ , \text{ and } \ x_3 \geq 0$$

_____ 3) Shortening the period needed to pay off a loan lowers the total interest paid.

_____ 4) $\$1,000$ invested at 7% compounded annually for $1-year$ produces more interest than investing $\$1,000$ at 7% simple interest for $1-year$.

_____ 5) Investing at 9% compounded monthly produces more interest than investing at 9% compounded annually?

_____ 6) Every minimization problem can be converted into a maximization problem.

Q.2 (12 points)   *Circle the correct answer.*

1) The pivot element in the following tableau is located in:

P	x_1	x_2	x_3	s_1	s_2	s_3	RHS
0	−1	2	1	1	0	0	200
0	0	−1	2	0	1	0	30
0	2	0	4	0	0	1	50
1	1	−2	3	0	1	0	30

(a) row 1 , col. 3   (b) row 3 , col. 1   (c) row 3 , col. 2   (d) No pivot

2) The solution of the standard minimum problem that has been solved by the ***Duality Principle*** and has the following final tableau is:

P	y_1	y_2	y_3	s_1	s_2	RHS
0	1	1	1	1	0	2
0	−1	1	0	−1	1	3
1	4	1	0	5	0	15

(a) $C_{min.} = 15$, $x_1 = 2$, $x_2 = 3$ (b) $C_{min.} = 15$, $x_1 = 5$, $x_2 = 0$

(c) $C_{min.} = 15$, $x_1 = 5$, $x_2 = 1$ (d) $C_{min.} = -15$, $x_1 = 5$, $x_2 = 0$

3) A loan of $200\ SR$ is made for 4 years at a simple interest rate 5%. What is the interest?

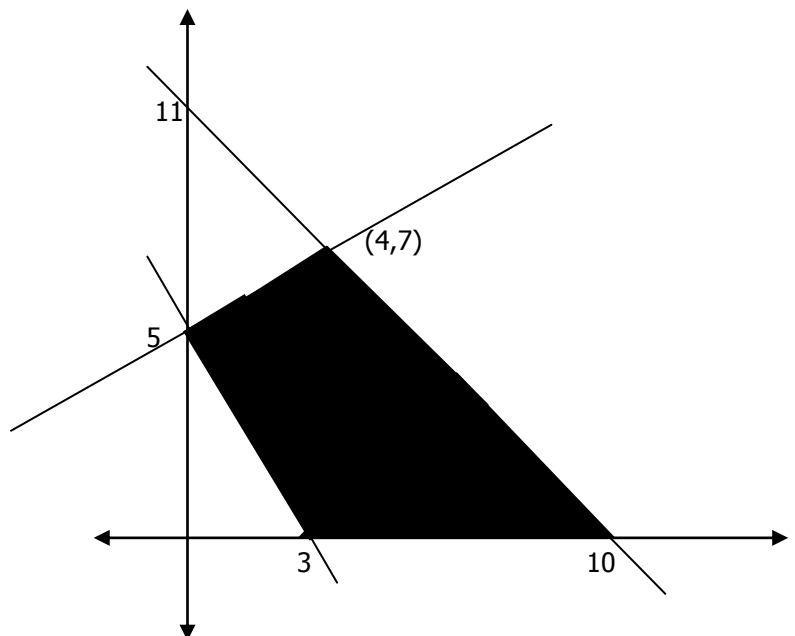   (a) $10\ SR$ b) $210.2\ SR$ c) $40\ SR$ d) $240\ SR$

4) The following tableau:

	P	x_1	x_2	s_1	s_2	RHS
	0	0	0	1	1	40
x_1	0	1	-1	0	1	20
	1	0	-2	0	1	20

   (a) is an initial tableau   (b) is a final tableau with $P_{max.} = 20$

   (c) requires additional pivoting   (d) indicates no solution

5) The maximum value of $P = 6x + 4y$ over the bounded region given below is:

   (a) $P_{max.} = 52$ at $(4,7)$

   (b) $P_{max.} = 44$ at $(0,11)$

   (c) $P_{max.} = 60$ at $(10,0)$

   (d) $P_{max.} = 58$ at $(4,7)$

6) The approximate number of years needed for any amount of money to quadruple(become four times) if invested at a rate of 5% compounded continuously is:

   (a) 28 years   (b) 20 years   (c) 30 years   (d) 25 years

7) The effective rate of interest for 10% compounded monthly is:

   (a) 10.52%   (b) 10.38%   (c) 10.42%   (d) 10.47%

8) Find the proceeds for a discounted loan of 45000 SR repaid in 20 months at 8%.

   (a) 51000 SR   (b) 117000 SR   (c) 39000 SR   (d) 41000 SR

3A

Q.3 (10 points)   Consider the following system of linear inequalities

$$\begin{cases} 3x + y \geq 6 \\ 3x + 4y \geq 12 \\ x \geq 0 \quad , \quad y \geq 0 \end{cases}$$

(i)   Graph the system and determine whether the graph is bounded or unbounded.

(ii)   Use the graph to find the maximum and minimum(if any) of the objective function $Z = 15x + 20y$

Q.4 (6 points)   A beverage company produces 2 colas: regular and diet. It costs $\$10$ to produce a carton of regular cola, and $\$12$ to produce a carton of diet cola. The company can produce a total of at most 5000 cartons of cola, and has a daily budget of no more than $\$3000$ to cover production costs. The profit is $\$2$ on each carton of regular cola, and $\$2.5$ on each carton of diet cola. How many cartons of each type of cola should the company produce in order to maximize its profit?

Set up the Linear Programming Problem _without solving._

Q.5 (10 points) A bank offers you two investment plans, plan A is investing 50000 SR at 9% simple interest rate for 12 years . Plan B is investing 45000 SR at 8% compounded quarterly for 10 years . Which plan will you take? (The plan that gives more interest)

5A

Q.6 (6 points) An initial investment of $\$4000$ grows to $\$4884$ in five years. If interest is compounded monthly, find the rate of interest compounded monthly that is earned by the money.

Q.7 (6 points) If $\$2000$ is invested in an account that earns 6.5% simple interest per year. How much is in the account after 20 months?

Q.8 (6 points) Omar had begun his Individual Retirement Account (IRA) at the age 30. He deposits 1000 SR every six months at an interest rate of 5% compounded semiannually. What would his IRA be worth at age 65?

Q.9 (6 points) John bought a Mercedes, taking out a loan for 30000 to help pay for it. He must re-pay the loan in equal monthly payments for 10 years, with an annual interest rate of 6% . what is his monthly payment?

Q.10 (12 points) Use the Simples Method to solve the Linear Programming Problem

Maximize $P = 50x_1 + 80x_2$ subject to:

$$x_1 + 2x_2 \leq 32$$
$$3x_1 + 4x_2 \leq 84$$
$$x_1 \geq 0 \quad , \quad x_2 \geq 0$$

Q.11 (8 points)   Find the Dual problem of the following minimum problem. **Don't Solve**

Minimize $C = 20x_1 + 16x_2$

Subject to the constraints

$$4x_1 + 3x_2 \geq 120$$
$$4x_1 + 8x_2 \geq 160$$
$$2x_1 + 4x_2 \geq 55$$
$$x_1 \geq 0 \text{ and } x_2 \geq 0$$

Q.12 (12 points)   Use the Simples Method to solve the Linear Programming Problem

Minimize $C = -5x_1 + 10x_2 + 15x_3$ Subject to the constraints

$$2x_1 + 3x_2 + x_3 \leq 24$$
$$x_1 - 2x_2 - 2x_3 \geq 1$$
$$x_1 \geq 0 \;,\; x_2 \geq 0 \;,\; \text{and} \; x_3 \geq 0$$