Prince Sultan University

Department of Mathematical Sciences

Major II Exam

Semester I, 2013 FALL (131)

December 04, 2013

MATH 101 – Finite Mathematics

Time Allowed : 90 minutes
Maximum Points: 80 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 mobile 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	23	
Q.3 , Q.4	13	
Q.5	9	
Q.6 , Q.7 , Q.8 , Q.9 , Q.10	21	
Q.11 , Q.12	14	
Total	**80**	

100

Q.1 (15 points) Circle the correct answer.

1) Find $n(A \cup B)$ given that $n(A) = 79$, $n(B) = 76$, and $n(A \cap B) = 13$

(a) 145 (b) 155 (c) 168 (d) 142

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

x	y	z	s_1	s_2	s_3	s_4	P	RHS
-1	2	1	1	0	0	0	0	3
0	-1	2	0	1	0	0	0	3
2	0	4	0	0	1	0	0	5
3	3	-3	0	0	0	1	0	6
1	-4	3	0	1	0	1	1	12

(a) row 1 , col. 2 (b) row 3 , col. 2 (c) row 4 , col. 2 (d) No pivot

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

u	v	w	s_1	s_2	P	RHS
1	1	1	1	0	0	2
-1	1	0	-1	1	0	3
4	1	0	5	0	1	15

(a) $C_{\min.} = 15$, $x = 2$, $y = 3$ (b) $C_{\min.} = 15$, $x = 5$, $y = 0$

(c) $C_{\min.} = 15$, $x = 5$, $y = 1$ (d) $C_{\min.} = -15$, $x = 5$, $y = 0$

4) The following tableau:

x	y	s_1	s_2	P	RHS
0	0	1	1	0	40
1	-1	0	1	0	20
0	-2	0	1	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) How many license plates consisting of two letters followed by four digits are possible? (Use the English alphabet with repetition of letters and numbers allowed)

(a) $\dfrac{26^2 10^4}{2!\ 4!}$ (b) $26^2 10^4$ (c) $C(26,2) \cdot C(10,4)$ (d) $P(26,2) \cdot P(10,4)$

6) How many nine-letter words can be formed from the letters of the word "**Classroom**"?

(a) $90,720$ (b) $3,024$ (c) $387,420,489$ (d) $362,880$

7) A classroom has 20 chairs and 12 students. If the student chooses to sit wherever he wants, in how many ways can this be done?

(a) $C(20,12)$ (b) $P(20,12)$ (c) $\frac{20!}{12!}$ (d) 240

8) Simplify the expression $\frac{70\cdot 69\cdot 68\cdot 67\cdot 66}{70!}$

(a) $\frac{1}{65!}$ (b) $65!$ (c) $\frac{1}{66}$ (d) $\frac{1}{65}$

9) How many $5-$letter words can be made using the first 10 letters of the alphabet?Repetition not allowed.

(a) 50 (b) $30,240$ (c) 252 (d) $9,765,625$

10) Five non-permanent seats in the UN Security Council are to be selected from among 10 countries. How many such sets of 5 nations are there?

(a) 50 (b) 252 (c) $30,240$ (d) $100,000$

Q.2 (8 points) Consider the following system of linear inequalities

subject to the constraints: $\begin{cases} 4x+y\le 16 \\ -x+y\le 6 \\ x\ge 0 \\ y\ge 0 \end{cases}$

(a) Graph the system

(b) Use the graph to find the maximize the objective function $P=4x+5y$

Q.3 (5 points) A company produces two types of steel. Type I requires 2 hours of melting, 4 hours of cutting , and 10 hours of rolling per ton. Type II requires 5 hours of melting, 1 hour of cutting, and 5 hours of rolling per ton. 40 hours are available for melting, 20 hours for cutting, and 60 for rolling. Each ton of Type I produces $240 profit, and each ton of Type II produces $80 profit. How many tons of each type should the company produce to maximum its profit?

Set up the Linear Programming Problem without solving.

Q.4 (8 points) Solve the following minimum problem linear programming problem using the **Dual problem**

Minimize $C = x + 2\,\mathrm{y}$

Subject to the constraints

$$2x - 3\,\mathrm{y} \geq 4$$
$$x - y \geq 8$$
$$3x + y \geq 4$$
$$x \geq 0 \ , \ y \geq 0$$

Q.5 (9 points) Use the **Simplex Method** to solve the following linear programming problem:

Maximize $P = 2x + 3y$

subject to the constraints

$$x + y \le 8$$
$$2x + y \ge 10$$
$$x + y \ge 4$$
$$x \ge 0, y \ge 0$$

Q.6 (4 points) You are arranging 17 books by color. 8 of these books are brown, 4 are black, and 5 are red. How many different ways are there to arrange the books?

Q.7 (3 points) How many **five-digit** numbers that are **even** can be formed from the digits 0 to 9 if repetition is allowed?

Q.8 (6 points) Consider the universal set *U*, and the sets *A*, *B*, and C given by $U = \{9,11,12,14,17,18,20\}$,

$A = \{9,17,18\}$ $B = \{11,12,17\}$, and $C = \{11,18\}$

Find a) $(A \cup B) \cap C$

b) $A' \cap B'$

c) $A' \cup B$

Q.9 (5 points) On a single shelf we are to arrange 4 different computer books and 5 different mathematics books. In how many ways can this be done if the computer books are to be grouped together and the mathematics books are to be grouped together?

Q.10 (3 points) How many different types of homes are available if a builder offers a choice of 6 basic plans, 3 roof styles, and 2 exterior finishes?

Q.11 (6 points) A $4-$person committee is selected out of two departments. Department A with 15 and department B with 20 people. In how many ways can the committee be selected if

(a) 3 people are selected from A and 1 from B

(b) 4 people are selected regardless of the department

(c) at least 3 people are selected from department B

Q.12 (8 points) A survey of 100 television viewers revealed the following information:

35 watch comedies

39 watch game shows

27 watch movies

16 watch movies and game shows

15 watch comedies and game shows

10 watch both comedies and movies

3 watch all three

(a) How many viewers watch none of these?

(b) How many viewers watch comedies but not game shows?

(c) How many viewers watch movies or comedies?

(d) How many viewers do not watch movies?