Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Level : B.Sc.
Year : III
Exam Roll No. :

Course : MATH 303
Semester : I
Time: 30 mins.
F. M. : 20

Registration No.:

Date : APR 13 2017

SECTION "A"

[10Q × 1=10 marks]

Fill in the blanks space(s) by most appropriate word(s) or symbol(s):

1. A linear programming technique improves the quality of ____________

2. The ____________ points of convex set give the basic feasible solution to the linear programming.

3. ____________ occurs when there is no solution that satisfies all of the constraints in the linear programming problem.

4. If the i^{th} primal constraint is of equality type, then i^{th} dual variable will be ____________

5. The addition of constraint in the existing constraints will cause a ____________ change in the objective function coefficient.

6. ____________ programming is an extension of linear programming in which feasible solution must have integer values.

7. If maximization Z= $2x_1 + 5x_2$ is the object function of LP-problem than 5 denotes ____________

8. If S be a set of vectors in $\boldsymbol{E^n}$, then the set of all convex combinations of every finite subset of S is called ____________ of set S.

9. A set of vectors $\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3, \ldots, \mathbf{a}_k$ is said to be ____________ if there exists real scalar quantities $c_1, c_2, c_3, \ldots, c_k$ not all zero such that $c_1\mathbf{a}_1 + c_2\mathbf{a}_2 + c_3\mathbf{a}_3, \ldots + c_k\mathbf{a}_k = \mathbf{0}$

10. The set of unit vectors $\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3, \ldots, \mathbf{e}_n$ is called ____________ in E^n.

SECTION "B"

[10 Q. ×1 = 10 marks]

Fill in the blank spaces (Q. N. 11 through 20) by choosing the most appropriate answers from among the given ones. Do not tick the answers.

11. Linear programming is the technique of ____________
    a. optimization b. sensitivity c. networking d. analysis

12. Matrix - form of constraints of LP-problem is ____________
    [$A^{-1}X = B$, $AX^{-1} = B$, $AX^{-1} = B$, $AX = B$]

13. To convert ≤ inequality constraints in to equality constraints, we must ________________________________

a. add a surplus variable
b. add a artificial variable
c. add a slack variable
b. subtract surplus variable and add a artificial variable

14. For minimization LP model, the simplex method is terminated when all values ____________

a. $c_j - z_j \geq 0$ b. $c_j - z_j \leq 0$ c. $c_j - z_j < 0$ d. $c_j - z_j > 0$

15. If a primal LP problem has a finite solution then the dual LP problem should have ________________

a. finite solution
b. infeasible solution
c. unbounded solution
d. negative solution

16. The entering variable in the sensitivity analysis of objective function coefficients is always a ____________________

a. decision variable
b. basic variable
c. non basic variable
d. slack variable

17. In a Branch and Bound minimization tree, the lower bounds on the objective function value ____________________

a. do not decrease in value
b. do not increase in value
c. remain constant
d. increase and decrease

18. A subset **S of** E^n is said to be ______________ if for all pair of points $\mathbf{x}_1, \mathbf{x}_2 \in$ **S**, any convex combination $c\mathbf{x}_1 + (1-c)\mathbf{x}_2$, for $0 \leq c \leq 1$ is also contain in **S**.
[convex set, hyper plane, polyhedral, convex hull]

19. Which of the following is a valid objective function for a linear programming problem?

a. Max $5xy$
b. Min $4x + 3y + (2/3)z$
c. Max $5x^2 + 6y^2$
d. Min $(x_1 + x_2)/x_3$

20. For a Minimization problem, the objective function coefficient for an artificial Variable is __________

[$+M$ $-M$ $\pm M$ Zero]

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APR 1 3 2017

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SECTION "C"

[3Q.× 7 = 21 marks]

1. An electrical company of Nepal produces two products A and B that are produced and sold on a weekly basis. Product A and B requires two men and one man as a labor respectively. The weakly production cannot exceed 25 for product A and 35 for product B because of limited available facilities. Profit margin on A and B are Rs. 60 and Rs. 40 respectively. If company has 60 employs. Formulate it as a linear programming problem and solve for maximum profit using graphical method. [1+6=7]

2. Explain multiple optimal solution of a LP- problem. Show that the following LP problem possesses multiple optimal solutions:
Maximize $Z = 10x_1 + 6x_2$ *subject to* $5x_1 + 3x_2 \leq 30$; $x_1 + 2x_2 \leq 18$; $x_1, x_2 \geq 0$ [1 +6=7]

OR

Find optimum solution cf following LP problem using Big - M method. [7]
Minimize $Z= 5x_1+3x_2$
Subject to the constraints:
$a)\ x_1 + 2x_2 \leq 6$ b) $x_1 + x_2 = 5$ c) $5x_1 + 2x_2 \geq 10$ and $x_1,\ x_2 \geq 0$

3. A firm manufactures two product A and B on machines I and II as shown below. [1 + 1 + 5=7]

Machine	Product		Available Hours
	A	B	
I	30	20	300
II	5	10	110
Profit per unit(Rs)	6	8	

The total time available is 300 hours and 110 hours on machines I and II respectively. Products A and B contribute a profit of Rs. 6 and 8Rs. per unit, respectively. Formulate it as a linear programming problem for optimum solution. Write the dual of this LP problem and solve.

SECTION "D"

[5Q.× 6 = 30 marks]

4. How does two –Phase method show whether given problem does not exits feasible solution. [2+ 4= 6]
Minimize $Z= x_1 - 2x_2 - 3x_3$
Subject to the constraints
$$-2x_1 + x_2 + 3x_3 = 2$$
$$2x_1 + 3x_2 + 4x_3 = 1$$
$$x_1, x_2, x_3 \geq 0$$

OR

What is unbounded solution? Show that following LP problem is unbounded. [1+5=6]

Maximize $Z= 3x_1+5x_2$

Subject to the constraints

a) $x_1 - 2x_2 \leq 6$ b) $x_1 \leq 10$ c) $x_2 \geq 1$ and $x_1, x_2 \geq 0$

5. Use dual simplex method to solve the following LP problem. [6]

Maximize $Z= -2x_1 - x_3$

Subject to the constraints

a) $x_1 + x_2 - x_3 \geq 5$ b) $x_1 - 2x_2 + 4x_3 \geq 8$ and $x_1, x_2, x_3 \geq 0$

6. Find from Gomory cutting plane method the solution for the following integer programming problem: [6]

Maximize $z = x_1 + x_2$

Subject to the constraints

a) $3x_1 + 2x_2 \leq 5$, b) $x_2 \leq 2$ c) $x_1, x_2 \geq 0$ and x_1, x_2 are integers

7. Find its optimal solution then make the sensitivity analysis of the problem for the range of coefficient C_1. [4+2=6]

Maximize $Z = 3x_1 + 5x_2$

Subject to the constraints

a) $3x_1 + 2x_2 \leq 18$ b) $x_1 \leq 4$ c) $x_2 \leq 6$ and $x_1, x_2 \geq 0$

8. Discuss the relation between primal variable and dual variable for a LP-problem. State and prove the week duality theorem. [2 + 4=6]

SECTION "E"

[2Q.× 2 = 4 marks]

9. Discuss the linear combination and span of a set of vectors. [1 + 1=2]

10. Define feasible solution and basic solution. [1 + 1=2]