Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

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

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

Registration No.:
Date MAR 1 9 2018

SECTION "A"

[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by most appropriate words or symbol(s):

1. Three parts of linear programming problem are ____________________

2. An ____________________ programming was used for capital budgeting.

3. Sensitivity analysis is also called ____________________

4. According to complementary slackness "Primal main variable x Dual surplus variable"= ____________________

5. In the dual-simplex method we always attempt to retain ____________________ while bringing the primal back to feasibility.

6. The constrain of the LP problem of the form: $5 \leq x \leq 10$ is called ____________________

7. ____________________ is the rate at which objective function improves if b_i corresponding to S_i is increased by a unit amount .

8. Types of integer programming problem are ____________________

9. One of the solution methods of LP-problem in which auxiliary objective function is formed first is called ____________________

10. While solving the integer programming problem we have to use ______________ method of solving LP problem apart from integer program's own method

SECTION "B"

[10 Q × 1=10 marks]

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

11. Branching and bounding method of integer programming problem divides the feasible solution space into smaller parts by ____________________
    a. Bounding b. Branching c. Enumerating d. Shifting

12. A non-basic variable should be brought into the new solution mix provided its contribution rate C_j is______________________________

a. $C_j^* = C_j + Z_j - C_j$

b. b. $C_j > C_j + Z_j - C_j$

c. c. $C_j < C_j + Z_j - C_j$

d. d. $Z_j > C_j$

13. $Z_j - C_j$ values in the non-basic slack variable columns = value of ______________________________ variables

a. Artificial b. Basic c. Non-basic d. Slack-basic

14. If any basic variable in the optimal table is zero then the problem is said to have______________________________solution.

a. Non-degenerate b. Unbounded c. Degenerate d. Alternative solution

15. Dual constraint for maximization LP problem can be stated as ______________________________

a. $\sum a_{ij} \geq C_j$ b. $\sum a_{ji} y_i \geq C_j$ c. $\sum a_{ij} y_j \leq C_j$ d. $\sum a_{ji} y_i \leq C_j$

16. If a primal LP-problem has a finite solution then the dual LP-problem should have______________________________solution.

[Finite, Infeasible, Unbounded Alternative]

17. Basic-slack variable s_2=5 indicates ______________________________

a. Second resource is shortage by amount 5

b. New objective function value is reduced by amount 5

c. Second resource is unused by amount 5

d. Constraint second is inconsistent by amount 5

18. Sensitivity analysis provides the range within which a parameter may change without offering______________________________

a. Old optimality b. New optimality c. Feasibility d. Infeasibility

19. The graphical method of LP problem uses ______________________________

a. Objective function equation b. Constraints equations

c. Linear equations d. All of above three

20. ______________________________is the valid objective function for the linear programming problem

a. $MinZ = xy$ b. $MinZ = 2x + 3y$

c. $MinZ = x^2 + y^2$ d. $Minz = \sqrt{x} + \sqrt{y}$

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SECTION "C"
[3Q × 7 = 21 marks]

1. A firm makes two products X and Y and has a total production capacity of 9 tons per day. Both X and Y requires the same production capacity. The firm has a permanent contract to supply at least 2 tones of X and at least 3 tones of Y per day to another company. Each tone of X requires 20 machine hours of production time and each tone of Y requires 50 machine hours of production time .The daily maximum possible number of machine hours is 360. All of the firm's output can be sold .The profit made is Rs. 80 per ton of X and Rs. 120 per ton of Y. (a) Formulate the problem as a linear programming problem (b) find by graphical method that how many units of each product should be produced in order to maximize the profit? [3.5+3.5]

2. What is the essential difference between regular –simplex method and dual –simplex method? Find the optimal solution of the following LP-problem by using dual-simplex method
Minimize $Z = 2x_1 + x_2$ Subject to

$$3x_1 + x_2 \geq 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \geq 3$$
$$x_1, x_2 \geq 0$$

3. What the sensitivity analysis is for? the linear programming problem

MaximizeZ $= 3x_1 + x_2 + 3x_3$ subject to
$$-x_1 + 2x_2 + x_3 \leq 4$$
$$2x_2 - \frac{3}{2}x_3 \leq 1$$
$$x_1 - 3x_2 + 2x_3 \leq 3$$
$$x_1, x_2, x_3 \geq 0$$
has the optimal table:

		C_j	3	1	2	0	0	0
C_B	Basis	$X_B = b$	x_1	x_2	x_3	s_1	s_2	s_3
3	x_3	$\frac{10}{3}$	0	0	1	4/9	1/9	4/9
1	x_2	3	0	1	0	1/3	1/3	1/3
3	x_1	$\frac{10}{3}$	1	0	0	1/9	7/9	10/9
		Z_j	1	3	3	2	3	5

a. Find the ranges within which C_3 , the coefficient of basic variable can be varied without altering this current optimal solution. [3.5]

b. Find the range of b_2 retaining the optimal solution. [3.5]

OR

Find the solution for the integer programming problem for the above problem with the help of the above optimal table. [7]

SECTION "D"

[5Q × 6 = 30 marks]

4. Show that the necessary and sufficient condition for a set S to be convex is that every convex linear combination of points in S belongs to S.

5. State the condition for linear programming problem to have infeasible solution and show by using Simplex method that the following LP-problem has infeasible solution [1+5]

$Maximize z = 3x_1 + 2x_2$ Subject to the constrains

$$2x_1 + x_2 \leq 2$$

$$3x_1 + 4x_2 \geq 12$$

$$x_1, x_2 \geq 0$$

OR

State the general formula for linear programming problem and show by using the big-M method that the following linear programming problem has the unbounded solution.[1+5]
$Maximize Z = 5x_1 + 7x_2$ Subject to the constrains

$$2x_1 - 2x_2 \geq 2$$
$$2x_1 + 2x_2 \geq 8$$
$$x_1, x_2 \geq 0$$

6. Solve the following LP-problem by two-phase method:

$Minimize z = 7.5x_1 - 3x_2$ Subject to the constrains

$$3x_1 - x_2 - x_3 \geq 3$$
$$x_1 - x_2 + x_3 \geq 2$$
$$x_1, x_2 \geq 0$$

7. Solve the following LP problem by using the big-M method:
Maximize $Z = 6x_1 + 4x_2$
Subject to the constraints

$$2x_1 + 3x_2 \geq 30$$
$$3x_1 + 2x_2 \leq 24$$
$$x_1, x_2 \geq 0$$

8. Show by using slack - variable method that the following LP-problem has alternative solution and also find the alternative solution.
Max $Z = 6x_1 + 3x_2$ subject to $2x_1 + x_2 \leq 8$

$$3x_1 + 3x_2 \leq 18$$
$$x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

SECTION "E"
[2Q × 2 = 4 marks]

9. Discuss
(i) Convex hull
(ii) Hyper plane

10. State point wise two applications of linear programming problem in Applied Physics.