KATHMANDU UNIVERSITY
End Semester Examination [C]
June 2018

Marks Scored:

Level : B.Sc.
Year : III

Course : MATH 303
Semester: I

Exam Roll No.:

Time: 30 mins.

F.M. : 20

Registration No.:

Date JUN 15 2018

SECTION "A"

[10 Q. × 1=10 marks]

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

1. Function 'f' is said to be linear if $f(x+y) =$ ----------

2. Complementary slackness is the relation between----------

3. The iso-profit line is the graph of----------function.

4. The reduced cost is the rate by which ----------
---

5. The initial solution table of LP-problem of two phase method is already optimal we find only.....solution

6. Generation of sequence of linear inequalities in the solution process of integer programming problem is called----------

7. Basis of the LP problem by Simplex method called ----------

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. In the solution of linear programming problem the objective function value does not improve in the subsequent iterations then it is called----------

10. Dual simplex method is used to study----------
---------- 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. LP theory states that the optimal solution to any problem will lie at----------
a) The origin. b) A corner point of the feasible region.
c) The highest point of the feasible region. d) The lowest point in the feasible region

12. A variable which does not appear in the basic variable column-B of the Simplex table is called ----------
a) Never equal to zero
b) Always equal to zero
c) Is called the basic variable
d) Is called non-basic variable

13. In Simplex method the situation in which we are unable to determine the pivot row then the problem is said to have ----------
a) Infeasible
b) Unbounded
c) Degenerate
d) Alternative solution

14. 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 5x2+ 6y2
d) Min (x1 + x2)/x3

15 Which of the objective function can be chosen for maximizing LP-problem----------
$[2x_1+x_2,$ $5x_1+5x_2,$ $3x_1+2x_2,$ $4x_1+3x_2]$

16. Addition of an additional constraint in the existing constraints will cause a ----------
a) Change in objective function coefficients C_j
b) Change in coefficients a_{ij}
c) Both (a) and (b)
d) Change in the range of b_i

17. Sensitivity analysis provides the range within which a parameter may change without offering ----------
a) Old optimality
b) New optimality
c) Feasibility
d) Infeasibility

18. Any feasible solution $x\epsilon R^n$which optimizes the objective function $Z = C^T X$ is called ---- ----------
a) Unbounded solution
b) Degenerate solution,
c) Non-degenerate solution,
d) Optimum solution

19. While solving an Integer Programming problem the word "fathom" is used in ---------- ----------
a) Gomory's cutting plane method,
b) Branch and bound method,
c) 0-1 integer method,
d) Pure integer programming method

20. If for a given solution a slack variable is equal to zero then----------
a) The solution is optimal.
b) The solution is infeasible.
c) The entire amount of resource with the constraint in which the slack variable appears has been consumed.
d) It indicates the shortage of resources.

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Semester: I
F.M. : 55

SECTION "C"
[3 Q.×7=21 marks]

1. Linear programming problem: Maximize $Z = 10x_1 + 15x_2 + 20x_3$ Subject to the constraints
$2x_1 + 4x_2 + 6x_3 \leq 24$; $3x_1 + 9x_2 + 6x_3 \leq 30$; $x_1, x_2, x_3 \geq 0$ has the following optimal table:

		C_j	10	15	20	0	0
C_B	B	X_B	x_1	x_2	x_3	s_1	s_2
20	x_3	2	0	-1	1	-1/2	-1/3
10	x_1	6	1	5	0	-1	1
$Z_j - C_j$			0	15	0	0	10/3

Find the ranges within which C_1 and C_2 can be varied without altering this current optimal solution.

2. Find the first Gomory's cut for the following integer programming problem

Maximize $Z = 7x_1 + 6x_2$

Subject to the constraints

$$2x_1 + 3x_2 \leq 12$$
$$6x_1 + 5x_2 \leq 30$$
$$x_1, x_2 \geq 0 \text{ and are integers}$$

3. Solve the following LP- problem by using the dual simplex method:

$Minimize\ Z = x_1 + 2x_2 + 3x_3$ Subject to the constraints

$$2x_1 - x_2 + x_3 \geq 4$$
$$x_1 + x_2 + 2x_3 \leq 8$$
$$x_2 - x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

OR

Find the solution for the primal with the help of the solution of the following dual LP-problem:

$Maximize\ Z = 30y_1 + 20y_2 + 16y_3$ Subject to the constraints

$$7y_1 + 5y_2 + 2y_3 \leq 3$$
$$2y_1 + 4y_2 + 8y_3 \leq 2$$
$$y_1, y_2, y_3 \geq 0$$

SECTION "D"

[5 Q.×6=30 marks]

4. The production of a certain manufacturing firm involves a machining process that acquires raw materials and then converts them into parts. These parts are then sent to one of the two divisions for being assembly into the final product. Division 1 is used for product A and division 2 for product B. Product A requires 40 units of raw material and 10 hours of machine processing time .Product B requires 80 units of raw material and 4 hours of machine processing time. During the period, 800 units of raw material and 80 hours of machine processing time are available. The capabilities of the two assembly divisions during the period are 6 and 9 units respectively. The profit contribution per unit to profit and overhead (fixed costs) is of Rs.200 for each unit of product A and of Rs.120 for each unit of product B. [3+3]

(i) Set up the mathematical model for the problem

(ii) Determine the optimal level of output for the two products using the graphical method.

5. 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.

6. State the formula for linear programming problem in matrix form and show by Simplex method that the following linear programming problem has the infeasible solution:

$Maximizez = 3x_1 + 2x_2$ Subject to the constrains

$$2x_1 + x_2 \leq 2$$
$$3x_1 + 4x_2 \geq 12$$
$$x_1, x_2 \geq 0$$

OR

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

$Minimizez = 7.5x_1 - 3x_2$ 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 $Z = 2x_1 + 3x_2$

Subject to the constraints

$$x_1 + x_2 \geq 6$$
$$7x_1 + x_2 \geq 14$$
$$x_1, x_2 \geq 0$$

8. Show that set of feasible solution is a convex set

SECTION "E"

[2 Q.×2=4 marks]

9. Discuss (i) convex set (ii) Hyper plane

10. State the elements of linear programming problem.