E 7256 (Pages : 3) Reg. No..............................

Name..................................

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2014

Fourth Semester

Complementary Course—OPERATIONS RESEARCH—NON-LINEAR PROGRAMMING

(For B.Sc. Mathematics Model II)

Time : Three Hours Maximum Weight : 25

Part A

Answer **all** *questions.*
Each bunch of **four** *questions has weight* 1.

I. 1 What is an integer vector ?

2 What is a pure integer programming problem ?

3 How does integer programming problem differ from a linear programming problem ?

4 A basic optimal solution of the LPP associated with an ILP is an optimal solution of the ILP. Write true or false.

II. 5 What do you mean by the term cut associated with an ILP problem ?

6 What is the disadvantage of cutting plane method ?

7 What are the two strategies adopted in branch and bound method ?

8 Give a strategy to reduce the number of steps involved in solving a ILP using cutting plane method.

III. 9 Define a saddle point.

10 The linear programming problem with equality constraints is covered by Kuhn-Tucker theorem. Write true of false.

11 Give an example of a convex programming problem.

12 For the problem minimize :

$z = x_1^2 + x_2^2 + x_3^2$, subject to

$$x_1 + x_2 + 3x_3 = 2$$
$$5x_1 + 2x_2 + x_3 = 5,$$

write the Lagrange function F (X).

Turn over

IV. 13 Give an example of a separable function.

14 What is non-linear programming problem ?

15 Write the general form of separable programming problem ?

16 How does quadratic programming problem differ from a L.P.P.

$(4 \times 1 = 4)$

Part B

Answer any **five** *questions.*
Each question has weight 1.

17 What is the effect of 'integer, restriction of all variables on the feasible space of IPP.

18 Explain whether an integer programming problem can be solved by rounding off the corresponding simplex solution.

19 Discuss the advantages of branch and bound method.

20 Why we prefer to find a lower bound than to find the minimum of the objective function of an integer linear programming problem while using branch and bound method ?

21 If $F(X, Y)$ has a saddle point $(X_0\ Y_0)$ for every $Y \geq 0$, then show that X_0 is a minimal point of $f(X)$ subject to the constraints $G(X) \leq 0$.

22 Mark on graph the set of feasible solutions of $(x_1 - 1)(x_2 - 1) \leq 1$, $x_1 + x_2 \geq 6, x_1 \geq 0, x_2 \geq 0$.

23 Write the K-T conditions and obtain the saddle point of minimize $f = (x_1 + 1)(x_2 - 2)$ over the region $0 \leq x_1 \leq 2$, $0 \leq x_2 \leq 1$.

24 Write short note on applications of non linear programming problem.

$(5 \times 1 = 5)$

Part C

Answer any **four** *questions.*
Each question has weight 2.

25 Prove that if an optimal solution of the problem minimize $f(X) = CX$ subject to $X \in S_F$ exists and T_F is non-empty, then optimal solutions of the problems minimize $f(X) = CX$ subject to $X \in T_F$ and minimize $f(X) = CX$ subject to $X \in [T_F]$ exist.

26 Solve by cutting plane method minimise

$4x_1 + 5x_2$ subject to

$3x_1 + x_2 \geq 2$,
$x_1 + 4x_2 \geq 5$,
$3x_1 + 2x_2 \geq 27$ x_1 and x_2 non-negative integers.

27 Express the following conditions as simultaneous constraints using 0 – 1 variables. Either $x_1 + 2x_2 \leq 4$ or $2x_1 + 3x_2 \geq 12$.

28 Describe the cutting plane method for solving an integer linear programming problem.

29 Use the K - T conditions to solve the problem, minimize

$$z = 6x_1^2 + 5x_2^2$$

subject to the constraints

$$x_1 + 5x_2 \geq 3,$$
$$x_1,\ x_2 \geq 0.$$

30 Solve the problem graphically : Maximize $z = x_1$, subject to the constraints

$$(1 - x_1)^2 - x_2 \geq 0,\ x_1, x_2 \geq 0.$$

(4 × 2 = 8)

Part D

Answer any **two** *questions.*
Each question has weight 4.

31 Solve by branch and bound method. Maximize $11x_1 + 21x_2$ subject to $4x_1 + 7x_2 + x_3 = 13$, x_1, x_2, x_3 non-negative integers.

32 Write the K-T conditions for the LP : Maximize $3x_1 + 2x_2$ subject to $2x_1 - x_2 \leq 4$, $x_1 + x_2 \leq 8$, $x_1 \geq 0, x_2 \geq 0$ and check these at each extreme point of the feasible set. From these find the solution.

33 Solve using separable programming technique maximize $f = 2x_1 - 3x_2$ subject to $4x_1^2 + 9x_2^2 \leq 36$, $x_1 \geq 0$, $x_2 \geq 0$.

(2 × 4 = 8)