*This question paper contains 3 printed pages.* *Your Roll No.* .....

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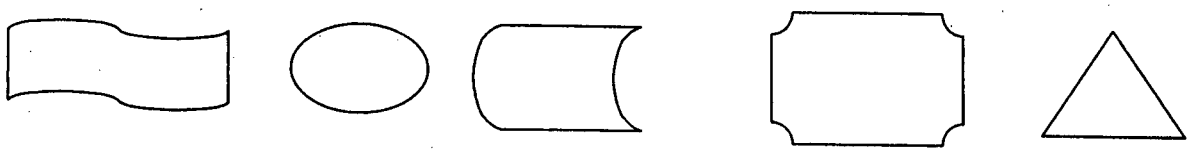
| *Sl. No. of Ques. Paper* | : 1969 | **GC–3** |
| *Unique Paper Code* | : 62361101 | |
| *Name of Paper* | : **Introduction to Operational Research and Linear Programming** | |
| *Name of Course* | : **B.A. (Prog.) Operational Research (CBCS)** | |
| *Semester* | : **I** | |
| *Duration* : | : **3 hours** | |
| *Maximum Marks* | : **75** | |

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt any five questions.*

Q1(a) What is Operational Research? List the advantages and limitations of O.R. approach in decision making. (2+6)

Q1(b) Define convex set. Determine whether the following sets are convex or not? Justify your answer.



(2+5)

Q2(a) State Weak Duality Theorem and Strong Duality Theorem.

Prove that dual of the dual is primal. (4+4=8)

(b) Write the dual of the following problem:

Max $Z=9\ x_1-7x_2+6\ x_3$

Subject to

$x_1+2x_2-\ x_3=10$

$2x_1+x_2+3x_3 <=16$

$5x_1-3x_2+\ 6x_3 >=12$

$x_1,x_2 >=0$ , $x_3$ unrestricted (7)

Q3(a) Define Basic Solution. Find all basic solutions to the following system of linear equations:

P.T.O

$x_1+2x_2+6x_3=4$

$2x_1+x_2+4x_3=12$

Identify which of them are feasible. (2+6)

Q3(b) What is sensitivity analysis. Discuss its advantages in business and industry.

What do you understand by feasibility range and optimality range while doing the sensitivity analysis for an LPP.

(7)

Q4(a) What conditions must exist in a simplex iteration to establish the existence of unbounded solution.

Solve the following L.P.P using simplex method:

Max $Z= 3x_1+4x_2$

S.T.

$-3x_1+2x_2 <=6$

$-4x_1+3x_2 <=18$

$x_1,x_2 >=0$ (2+5)

Q4(b) To maintain his health, a person must fulfill certain minimum daily requirements for several kinds of nutrients . Assume that there are only three kinds of nutrients- calcium, protein and carbohydrates and the person's diet consists of only two food items I and II ,whose price and nutrient contents are shown in the table below:

| | Food I (per lb) | Food II (per lb) | Minimum daily requirement |
|---|---|---|---|
| Price(Rs.) | 0.6 | 1.0 | |
| calcium | 10 | 4 | 20 |
| protein | 5 | 5 | 20 |
| carbohydrates | 2 | 6 | 12 |

Formulate above as a Linear Programming Problem. Use graphical method to find the combination of the two food items will satisfy the daily requirement and entail the least cost?

(8)

Q5(a) Solve the following LPP by Dual Simplex method :

Minimize $Z=2x_1+3x_2$

s.t.

$2x_1+2x_2 <=30$

$x_1+2x_2 >=10$

$x_1, x_2 >=0$ (7)

Q5(b) Explain how would you identify the cases of redundant constraint, no solution , multiple solution and unbounded solution from the graph of LPP involving two variables. Give a rough sketch in each case. (8)

Q6 (a) Solve the following LPP by Two-Phase method :

Max. $Z=3x_1+2x_2$

s.t.

$2x_1+x_2 <=2$

$3x_1+4x_2 >= 12$

$x_1, x_2 >=0$

(8)

Q6(b) Solve the following problem by simplex method .

Max $Z=3 x_1+2x_2$

s.t.

$6x_1+4x_2 <=90$

$x_1+x_2 <=40$

$x_1 >=5$

$x_1,x_2 >=0$

Does the problem have multiple solutions? If yes, then find one alternate optimal solution. (7)

Q7 . Write short notes on any three of the following

i. Degeneracy
ii. Simplex method Vs Dual simplex method
iii. Economic interpretation of duality.
iv. Complementary slackness (3*5=15)