Department of Mathematics

Pattamundai College, Pattamundai

6th Semester

Linear Programming

Core - 14

Section - A

1. a) What are the three components of linear programming problem?

   b) Write the different steps inorder to form the mathematical formulation of LPP.

   c) Which of the following is not associated with an LPP ?

   i) Proportionality (ii) Uncertainty (iii) Additivity (iv) Divisibility

   d) What is the restriction for a constraint in a LPP ?

   e) What is the meaning of minimization of objective function in LPP ?

   f) Why new negative condition is an important component of LPP ?

   g) Variables can be unrestricted in the context of an LPP (True / False)

   h) The graphic approach to an LPP is applicable when the number of decision variables are more than the number of constraints (True / False)

   i) A feasible solution to an LPP must satisfy all the problem's constraints simultaneously. (True/False)

   j) It is not possible to obtain feasible solution of an LPP by graphical method (True/False)

   k) If two constraints do not intersect in the positive quadrant of the graph then the solution is infeasible (T/F)

   l) Using graphic method, the optimum solution of the LPP of maximizing $z = 10x + 15y$ subject to $2x+y \leq 26$, $x+2y \leq 28$, $y-x \leq 5$, and $x \geq o$, $y \geq o$ is obtain as _____

   m) An iso-cust line cannot be parallel to the line of any constraint. (True/False)

   n) Given a system of m simultanloly linear equation in n unknowns ($m < n$), the number of basic variables will be _____

   o) For maximization liner programing problem, the simplex method is terminated when all the net evaluations are negative (True / False)

   p) Solution by simplex method requives that an LPP should have at least one non negative values in the right hand side of the constraints (True / False)

P.T.O.

q) What is the role of artificial variables in simplex method ?

r) For maximization LPP, the objective function coefficient for an artificial variable is _____

s) If an optimum solution is degenerate then what happened ?

t) When we solve a system of simultaneous linear equations by using Two-phase simplex method the values of decision variables may be positive and / or negative. (True/False)

u) If dual has an unbounded solution, primal has _____

v) Dual simplex method is applicable to these LPP's that state with an infeasible but optimum solution (True/ False)

w) All scarce resources have marginal profitability equal to zero (True/False)

x) If the number of primal variables is very small and the number of constraints is very large, then it is more efficient to solve the dual rather than the primal problem . (True/False)

y) The transportation problem deals with the transportation of a single product from several sources to a destination (True/False)

z) The transportation problem is balanced, if total demand equals total supply irrespective of the number of sources and destinations. (True/False)

2. a) The solution to a transportation problem with m-sources and n-destinations is feasible, if the number of allocations are _____

b) While solving a transportation problem the occurrence of degeneracy means the solution so obtained is not feasible. (True / False)

c) In vogel's approximation method the cost difference indicate the penalties for not using the respective least cost - routes (True/ False)

d) The initial solution of a T.P. Obtained by VAM would invariably be very near to optimum solution (True/False)

e) The dummy source or distention in a T.P. is introduced to satisfy rim conditions. (True/False)

f) Any of the m+n–1 number of occupied cells would allow determining whether a given solution is optimum or not ? (True/False)

g) For a transhipment problem an m source, n destination transportation problem, when written as a transhipment problem would have m+n sources and n destinations. (True/False)

h) The assignment problem is a special case of transportation problem in which number of Origins equal to the number of _____.

i) Why an assignment problem is consider as a particular case of transportation problem .

j) If there are n workers and n jobs, there would be _____ solutions.

k) In an assignment problem involving four workers and three jobs, total number of assignments possible are _____

l) Which method is used for solving an assignment problem ?

m) An assignment problem can be solved by transportation method and simplex method (True/False)

n) For a salesman, who has to visit n cities, _____ number of ways he can made his tour plan.

o) Define 'A game is said to be fair'

p) When maximin and minimax values of the game are same then there is a saddle point. (True/False)

q) A mixed strategy game can be solved by _____ methods.

r) The size of the pay-off matrix of a game can be reduced by using the principles of _____

s) Game which involve more than two players are called _____ games.

t) If the pay- off matrix of a game is transposed, saddle point of the game of exists changes. (T/F)

u) In a two person zero-sum game player A's strategy is determined on the basis of maximum Griterion, Where as the basis of maximum criterion, where as player B's on the basis of minimax criterion / (T/F)

v) In a two person zero sum game strategies of the players are played in random order in the ratio determined by the optimum mix. (True/ False)

w) In a two person zero sum game, Row/column player is said to dominate the other player if he has more strategies to play (True/False)

Section - B

1.a) Explain the linear programming problem giving two examples ?

b) What are the components of linear programming model ?

c) Give the general form of a basic model of linear programming ?

d) State any two applications of linear programming ?

e) Explain the advantages of linear programming and its limitations.

f) Explain the major characteristics of a linear programming problem.

g) What are the major assumptions and limitations of linear programming ?

h) “Linear programming has no real application” Do you agree ? Discuss.

i) “Linear programming is useful Management science Technique, but it has some limitations”. Discuss it and give appropriate examples.

j) Write down the standard form of a LPP.

k) What is feasible region ? Is it necessary that it should always be a convex set ?

l) Illustrate graphically the following special cases of liner programming problems :

i) Multiple optimal solution.

ii) No feasible solution.

iii) Unbounded solution.

m) Define slack and surplus variable in LPP.

n) State the general linear programming problem in

i) Standard form

ii) Cannonical form

o) With the help of suitable sketches, define convex, non convex and infeasible region in relation to the graphical solution of a linear programming problem.

p) Define the following terms

i) Basic variable

ii) Basic solution

iii) Basic feasible solution

iv) Degenerate basic solution.

q) Differentiate between basic and non-basic variables . What is an artificial variable and why should it be introduced into a solution.

r) What are the two conditions to be satisfied to perform optimality test ?

s) While solving a liner programming problem.

Maximize z = (x st Ax = b, x $\geq$ o : what indicates the following ?

i) Unique optimal solution

ii) Presence of redundant constraints.

iii) No feasible solution.

t) How do you conclude that a LPP has an infeasible solution while using simplex method ?

u) How do you identify multiple solution in a linear programming problem ?

v) What do you mean by the two phase method for solving a given LPP ?

w) Define dual . Give any two relationships between a primal and a dual ?

x) State the duality theorem.

y) State the general rules for forms a dual LPP from its dual.

z) Write short note on 'Complementary slackness'

2. a) Give the application of duality theory

b) What is transportation problem ?

c) What is a balanced transportation problem ? What are its applications ?

d) Give a brief outline of the procedure for solving a transportation problem.

e) Explain the following in the context of T.P.

i) Stepping stone method

ii) Degenerate Transportation problem

iii) Modified distribution method.

f) What is an assignment problem ?

g) Give two applications of assignment problem in health care administration.

h) Give the mathematical formulation of an assignment problem.

i) Explain the difference between a transportation problem and an assignment problems.

j) "An assignment problem is a special case of a transportation problem". Explain

k) Explain Hungarian algorithm.

l) Can there be multiple optimal solutions to an assignment problem ? How would you identify the existence of multiple solutions, if any ?

m) How does travelling salesman problem differ from an assignment model ?

n) Write a short note on Travelling salesman problem.

o) What is game Theory ?

p) Explain advantages and disadvantages of game Theory ?

q) Define the term 'strategy' and 'optimal strategy' with reference to game theory.

r) Explain the concept of value of a game.

s) Discuss dominance with reference to game theory.

t) What are the major applications of game theory ?

u) Define saddle point. Is it necessary that a game should always possess a saddle point ?

Section - C

1. a) An animal feed company must produce 200lbs of a mixture containing the ingredients x_1 and x_2. x_1 costs Rs 3 per lb and x_2 costs Rs 8 per lb. Not more than 80lbs of x_1 can be used and minimum quantity to be used for x_2 is 60lbs. Find how much of each ingredient should be used of the company wants to minimize the cost. Formulate.

b) Use graphical method to solve the LPP Maximize $z = 2x_1 + 4x_2$ subject to the constraints :

$x_1 + 2x_2 \leq 5$, $x_1 + x_2 \leq 4$: and $x_1, x_2 \geq 0$

c) Consider the following LPP :

Maximize $Z = 3x_1 + 7x_2$ subject to the constraints :

$4x_1 + 5x_2 \leq 20$, $2x_1 + x_2 \leq 6$, $2x_1 \geq 7$, $2x_2 \leq 7$:

$x_1 \geq 0$, $x_2 \geq 0$.

Demonstrate whether it is possible to get a solution to the above LPP.

d) Reduce the following LPP to its standard form:

Maximize $z = x_1 - 3x_2$ subject to the constants :

$-x_1 + 2x_2 \leq 15$, $x_1 + 3x_2 = 10$

x_1 and x_2 unrestricted in sign

e) Show that the following system of linear equations has a degenerate solution :

$2x_1 + x_2 - x_3 = 2$

$3x_1 + 2x_2 + x_3 = 3$

f) Find all the basic feasible solutions of the equations :

$2x_1 + 6x_2 + 2x_3 + x_4 = 3$

$6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$

g) Let $x_1 = 2$, $x_2 = 4$ and $x_3 = 1$ be a feasible solution to the system of equations

$2x_1 - x_2 + 2x_3 = 2$

$x_1 + 4x_2 = 18$

Reduce the given feasible solution to a basic feasible solution.

h) Use simplex method to solve the LPP

Maximize $Z = 4x_1+5x_2+9x_3+11x_4$ subject to the castrations :

$x_1 + x_2 + x_3 + x_4 \leq 15$

$7x_1 + 5x_2 + 3x_3 + 2x_4 \leq 120$

$3x_1 + 5x_2 + 10x_3 + 15x_4 \leq 100$

$x_1, x_2, x_3, x_4 \geq 0$

i) Use two phase simplex method to solve

Maximize $z = 5x_1 - 4x_2 + 3x_3$

s.t. the constraints :

$2x_1 + x_2 - 6x_3 = 20$, $6x_1+5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$, $x_1, x_2, x_3 \geq 0$

j) Solve the following LPP

Maximize $z = 2x_1+3x_2+10x_3$ s.t. the constraints :

$x_1+2x_2 = 0$, $x_2+x_3=1$: $x_1, x_2, x_3 \geq 0$

k) Solve the following system of simultaneous lienor equations by using the simplex method :

$x_1 + x_2 = 1$, $2x_1 + x_2 = 3$

l) Formulae the dual of the following LPP :

Maximize $z = 10x_1 + 8x_2$ s.t. the constraints :

$x_1 + 2x_2 \geq 5$, $2x_1 - x_2 \geq 12$, $x_1 + 3x_2 \geq 4$,

$x_1 \geq 0$ and x_2 is unrestricted.

m) Use duality to solve the following LPP :

Maximize $z = 2x_1 + x_2$ s.t the castanets :

$x_1 + 2x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$,

$x_1 - 2x_2 \leq 1 : x_1, x_2 \geq 0$

n) Use dual simplex method to solve the following LPP :

Minimize $Z = 3x_1 + x_2$ s.t. the constricts :

$x_1 + x_2 \geq 1$, $2x_1 + 3x_2 \geq 2$, $x_1, x_2 \geq 0$

o) Use Vogel's Approximate method to obtain an initial basic feasible solution of the transportation problem :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

p) Given $x_{13} = 50$ units, $x_{14} = 20$ units, $x_{21} = 55$ units $x_{31} = 30$ units, $x_{32} = 35$ units only $x_{34} = 25$ units. Is it an optimal solution to the transportation problem :

				Available units
6	1	9	3	70
11	5	2	8	55
10	12	4	7	90
Required units : 85	35	50	45	

If not, modify it to obtain a better feasible solution.

q) Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows :

		Job 1	2	3	4	5
person	A	8	4	2	6	1
	B	0	9	5	5	4
	C	3	8	9	2	6
	D	4	3	1	0	3
	E	9	5	8	9	5

Determine the optimum assignment schedule.

r) Solve the game whose payoff matrix is giving by ,

		Player A A_1	A_2	A_3
Player B	B_1	1	3	1
	B_2	0	–4	–3
	B_3	1	5	–1

s) Solve the following 2-person zero-sum game :

i)

	Player B		
Player A	15	2	3
	6	5	7
	–7	4	0

ii)

	Player B		
Player A	–2	12	–4
	1	4	8
	–5	2	3

t) Determine the optimum strategies and the value of the game from the following 2×5 pay off matrix game for x :

	Y				
x	6	3	–1	0	–3
	3	2	–4	2	–1

u) Consider the following 2×2 game :

$$\begin{bmatrix} 4 & 7 \\ 6 & 5 \end{bmatrix}$$

i) Does it has a saddle point ?

ii) Is it correct to state that the value of game G, will satisfy $5 < G < 6$?

iii) Determine the frequency of optimum strategies by matrix oddment method and find the value of game .

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