Linear Programming Problems - Web course

COURSE OUTLINE

Linear programming problems, basic theory, simplex algorithm, two phase method, duality, dual simplex method, post optimality analysis, complexity issues of simplex algorithm, Karmarkar interior point method, transportation and assignment problems, simple network models, linear integer programming, matrix game theory.

COURSE DETAIL

Module	Topics
1	i. Linear programming modeling, Optimal solutions and graphical interpretation of optimality. ii. Notion of convex set, convex function, their properties & applications in context of LPP. iii. Preliminary definitions (like convex combination, extreme point etc.). iv. Optimal hyper-plane and existence of optimal solution of LPP.
2	i. Basic feasible solutions: algebraic interpretation of extreme point. ii. Relationship between extreme points and corresponding BFS. iii. Adjacent extreme points and corresponding BFS along with examples. iv. Fundamental theorem of LPP and its illustration through examples.
3	i. LPP in canonical form to get the initial BFS & method of improving current BFS. ii. Case of unbounded LPP, Simplex algorithm and illustration through examples. iii. Artificial variables and its interpretation in context of feasibility.
4	i. Two phase method and illustration. ii. Degeneracy and its consequences including cases of cycling.
5	i. Introduction to duality & formulation of dual LPP for different models through examples. ii. Duality theorems and their interpretations. iii. Complementary slackness theorem, Farkas Lemma, Examples. iv. Economic interpretation & applications of duality. v. Dual simplex method and its illustration.
6	i. Post optimality analysis: the cases of change in resources, change in cost coefficients. ii. Sensitivity analysis for addition and deletion of

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Mathematics

Additional Reading:

1. Linear Programming and Extensions, G. B. Dantzig, Princeton University Press.
2. Linear Programming, G. Hadley, Narosa.
3. Operations Research: An Introduction, H. A. Taha, Pearson Education.
4. Numerical Optimization with Applications, S. Chandra, Jayadeva, A. Mehra, Narosa.
5. Linear Programming, K.G. Murty, John Wiley.
6. Linear Programming, V Chvatal, W. H. Freeman.

Coordinators:

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	variables and constraints.
7	i. Complexity issues of LPP & introduction to interior point method. ii. Karmarkar's interior point method. iii. How to model the given LPP in Karmarkar's framework. iv. Complexity issue of Karmarkar's method.
8	i. Integer programming: modeling & a look at its feasible set. ii. Gomory cut algorithm and derivation of cut equation. iii. Examples. iv. Branch and Bound algorithm.
9	i. Special LPPs: Transportation programming problem, modeling, and unimodular matrix. ii. Initial BFS and optimal solution of balanced TP problem. iii. Other forms of TP and requisite modifications. iv. Assignment problems and permutation matrix. v. Hungarian Method.
10	i. Additional topics: Weighted network problem and LPP formulation. ii. Network simplex algorithm. iii. Matrix game and concept of saddle point. iv. Graphical solution and rule of dominance. v. LPP and matrix game equivalence.

References:

1. Linear Programming, G. Hadley, Addison Wesley
2. Linear Programming: Foundation and Extensions, Robert J. Vanderbei, Springer
3. Linear Programming and Network Flows, M.S. Bazararaa, J.J. Jarvis, H.D.Sherali, John Wiley