# **[WI000275] Management Science**

**PROFFESSOR**

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**TOPICS OVERVIEW**

1. **INTRODUCTION**

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| * 1. Management Science and Operation Research |  |  |
| * 1. Process model |  |  |

1. **LINEAR PROGRAMMING**

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| * 1. Graphical solution of Linear programming      1. Modelling * Decision variables * Objective function * Constraints (production /warehouse /demand)   + 1. Solving linear programs graphically * Constraints * Feasible region * Objective function * Optimal solution |  |  |
| * 1. Simplex Algorithm      1. Canonical form      2. Basic Variables      3. Non-basic variables   -   * + 1. Basic feasible solution     2. Optimal solution   -   * + 1. Change of the Basis   -   * + 1. Pivoting     2. Negative coefficient in Pivot Column   -   * + 1. LP in Tableau format     2. Pivoting in Tableau format   1. Formal presentation of the Simplex Algorithm |  |  |
| * 1. Transformation of LP in canonical form      1. Constraints type **≤**      2. Constraints type **≥**      3. Constraints type =      4. Constraints type - negative right hand side   -   * + 1. Real (Unrestricted or Free) Variables |  |  |
| * 1. M-Method      1. Motivation      2. Rules |  |  |
| * 1. Shadow prices and reduced costs      1. Shadow price      2. Reduced costs      3. Relation |  |  |
| * 1. Duality      1. Motivation      2. Rules for obtaining dual LP (Correspondence between Primal and Dual Problem)      3. Properties      4. Change of the objective function value |  |  |
| * 1. The Dual Simplex Method      1. Motivation      2. Rules (Obtaining the Dual LP)      3. Transforming the Dual LP into Max Objective Function Value      4. Formal presentation of the Dual Simplex Method |  |  |
| * 1. Special cases      1. No feasible solution      2. Unbounded LP      3. Multiple optimal solutions      4. Redundant constraint      5. Primal Degeneracy |  |  |
| * 1. Sensitivity analysis      1. Motivation      2. Changing the objective function coefficient of a Non-Basic variable      3. Changing the objective function coefficient of a Basic Variable |  |  |

1. **INTEGER AND MIXED-INTEGER PROGRAMS (MIP)**

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| * 1. Integer program / Mixed-integer program / Binary program      1. LP-relaxation |  |  |
| * 1. Branch-and-bound      1. LP-Relaxation with the Simplex Method      2. LP-relaxation without Simplex Method   -   * + 1. Limited Branch-and-Bound |  |  |

1. **GRAPH THEORY AND NETWORK FLOW PROBLEMS**

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| * 1. Graph theory      1. Basics      2. Determination of minima |  |  |
| * 1. Network flow problems      1. Cost minimization      2. The transport problem      3. The assignment problem      4. Maximum flow   -   * + 1. Ford-Fulkerson algorithm |  |  |

1. **DYNAMIC PROGRAMING**

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| * 1. Dynamic order quantity problem |  |  |
| * 1. Capital budgeting problem |  |  |
| * 1. Allocation of employees |  |  |

1. **DECISION THEORY**

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| * 1. Decision-making situations |  |  |
| * 1. Decision with uncertainty      1. Decision matrix and efficient alternatives   -   * + 1. Maximin rule     2. Maximax rule     3. Hurwicz rule     4. Min-max Regret rule     5. Laplace rule |  |  |
| * 1. Decision at risk: expectation use theory      1. Representation of alternatives as lotteries      2. St.Petersburg paradox   -   * + 1. Utility function and expectation     2. Method for determining the utility function     3. Risk attitude of decision makers     4. Decision matrix and expected utility theory |  |  |
| * 1. Decision-Related Risk: Prospect Theory      1. Total value of lotteries |  |  |
| * 1. Decision-making risk: μ-σ-criterion |  |  |
| * 1. Multi-level risk decisions: decision-making process      1. Elements of a decision tree      2. Method for solving the decision tree      3. Software systems for decision-making tree procedures   -   * + 1. Value of information   -   * + 1. Sensitivity analysis     2. Decision tree and expectation     3. Decision-making tree and investment calculation   -   * + 1. Value of Real options |  |  |
| * 1. Security and multiple objectives: value analysis      1. Carrying out the value analysis      2. Sensitivity analysis |  |  |

1. **MONTE CARLO SIMULATION**

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| * 1. Basic Monte Carlo Simulation |  |  |
| * 1. Two application examples      1. Transfer to companies      2. Investment accounting for pharmaceutical companies |  |  |

**READING**

1. Bradley, S.P., A.C. Hax und T.L. Magnanti: Applied Mathematical Programming, Addison-Wesley, 1977.

<http://web.mit.edu/15.053/www/>

1. Domschke W and A. Drexl: Einführung in Operations Research, 9th Ed., Springer, 2015.
2. Hillier FS and Lieberman GJ: Introduction to Operations Research, 9th ed., McGraw-Hill, 2010. Winston WL: Operations Research, 5th Ed., Thomson, 2004."