

Al-Farabi Kazakh National University

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MATHEMATICAL PROGRAMMING

Textbook

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Some theoretical foundations of mathematical programming are expounded in the textbook: elements of convex analysis, convex, nonlinear, linear programming required for planning and production control for solution of the typical problems of the controlled processes in natural sciences, technology and economy.

The tasks for independent work with concrete examples, brief theory and solution algorithms of the problems, term tasks on sections of the mathematical programming are put in the appendix.

It is intended as a textbook for the students of the high schools training on specialties "applied mathematics", "mathematics", "mechanics", "economic cybernetics" and "informatics". It will be useful for the post-graduate students and scientific workers of the economic, mathematical, naturally-technical and economic specialties.

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FOREWORD

The main sections of mathematical programming, the numerical methods of function minimization of the finite number variables are expounded in the textbook. It is written on the basis of the lectures on optimization methods which have been delivered by the authors in Al-Farabi Kazakh National University.

In connection with transition to credit technology of education the book is written in the manner of scholastic-methodical complex, containing alongside with lectures problems for independent work with solutions of the concrete examples, brief theory and algorithm on sections of the course, as well as term tasks for mastering of the main methods of the optimization problems solution.

In the second half XX from necessity of practice appeared the new direction in mathematics - "Mathematical control theory" including the following sections: mathematical programming, optimal control with processes, theory of the extreme problems, differential and matrix games, controllability and observability theory, stochastic programming. Mathematical control theory was formed at period of the tempestuous development and creating of the new technology, spacecrafts, developing of the mathematical methods in economy, controlling by the different process in natural sciences. Aroused new problems could not be solved by classical methods of mathematics and required new approaches and theories. The different research-and-production problems were solved due to mathematical control theory, in particular: production organizing to achieve maximum profit with provision for insufficiency resources, optimal control by nucleus and chemical reactors, electrical power and robotic systems, control by moving of the ballistic rockets, spacecrafts and satellites and others. Methods of the mathematical control theory were useful for developing mathematics. Classic boundary problems of the differential equations, problems of the best function approach, optimal choice of the parameters in the iterative processes, minimization of the difficulties with equations are reduced to studying of the extreme problems.

Theory foundation and solution algorithms of the convex, nonlinear and linear programming are expounded on the lectures 1-17. Execution of the three term tasks for individual work of the students is provided for these sections.

Solution methods of the extreme problems are related to one of the high developing direction of mathematics. That is why to make a textbook possessed by completion and without any shortage is very difficult. Authors will be grateful for critical notations concerning the textbook.