

SYNOPSIS:

”DECISION MAKING: COMBINATORIAL MODELS OF INFORMATION APPROXIMATION”

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1. Dr. Anatoly R. BELKIN (born in 1955, Moscow) received the M.S. degree in system analysis (1978) from Moscow Physical-Technical Institute. He holds Ph.D. degree in mathematical cybernetics (1981) from the same institute. From 1981 to 1989 Dr. Belkin was involved in various theoretical areas, R & D projects of medical cybernetics, computer systems, decision support systems. Now he is the head of DSS sector of Institute for Computer-Aided Design, USSR Academy of Sciences (Moscow).

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Both of the authors are considered to be well experienced specialists in such fields as: combinatorial models in decision making, intelligent DSS, discrete optimization problems.

2. Abstract. The original description of multicriteria discrete DM problem resolving process is proposed. Actually, this process is now represented as a step-by-step transformation of preference structures. The standardization of such new approach is conducted, the investigation of basic preference structures, standard problems of data transformation and formal models being implied. The techniques of linear ordering, group ranking and knapsack problem solving are considered in details.

Such original approach sets the foundations of standard instrumental DSS for the intelligent flexible information processing DM technologies, the way to practical application of the technological approaches to real DM problems being foreseen thereafter.

Several examples of applications for various domains are available (control of production quality, computer network design, housebuilding, etc.). The examples included give and a real opportunity to non-experienced reader (e.g., engineer, manager, architect, etc.) to get acquainted with the DM concepts and their real basis. The book generalizes the results of the recent authors's theoretical and practical investigations.

3. Contents.

Introduction. The main targets and problems.

Chapter 1. Decision Making (DM) and structure transformation problems.

1.1 Architecture level of DM interactive systems.

1.2 Common scheme of DM problem solving.

1.3 Basic kinds of structures.

1.4 Structure transformation problems.

Chapter 2. Formal models and DM problems

2.1 The techniques of preference structure description

2.2 Simulating of DM process

2.3 Standard types of formal models

Chapter 3. Linear ordering techniques.

3.1 Main properties of linear ordering models.

3.2 The properties of several specific models.

3.3 Some results of the comparative analysis of the models.

Chapter 4. Group ranking.

4.1 Group ranking models and their properties.

4.2 Layered structures with maximal conformity.

4.3 Other models of group ranking

Chapter 5. The set of objects choice models and the knapsack problem (KP).

5.1 Principal types and characteristic properties of some knapsack-like models.

5.2 The simplest models.

5.3 Models with hierarchical constraints

5.4 Models with given quasi-ordering.

5.5 Generalized knapsack problem.

5.6 Several alternative generation models with specific character of inter element logical relations.

Chapter 6. Practical examples.

6.1 Complex analysis of machinery production quality.

6.2 The choice of principal quality attributes for equipment.

6.3 Analysis of the importance of equipment components faults.

6.4 Design of communication links in information computer systems. 6.5 Planning of construction engineering in city.

6.6 One forecast problem.

Additions to Chapter 5. Vector criterion for layered structures.

Conclusion. Summary and recommendations.

Bibliography. 197 references

4. The book was read and appreciated by several well-known specialists in decision-making, artificial intelligence, and combinatorial optimization, namely Academicians S.V. Emelyanov and G.S. Pospelov, Dr. Sci. V.M. Solodov, Dr. Sc.V.I. Tsourkov and some others. Their recommendations note the high scientific level of the book, the desirability of its publishing being underlined specially.