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Physical and mathematical basis for decision making using weather and climate information for the energy sector

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Decision Making (DM) problem is of great practical value in many areas of human activities. Most widely used DM methods are based on probabilistic approaches. Well-known Bayesian theorem for conditional Probability Density Function (PDF) is a background for such techniques. It is due to some uncertainty in many parameters entered in any model described functioning of many real systems or objects. Uncertainty in our knowledge might be expressed in alternative form. I offer to employ appropriate confidential intervals for model parameters instead of relevant PDF. Thus one can formulate a prior uncertainty in model parameters by means of a set of linear constraints. Related cost or goal function should be defined at corresponding set of parameters. That leads us to statement of problem in terms of operational research or mathematical linear programming. It is more convenient to formulate such optimization problem for discrete or Boolean variables. Review of relevant problem statements and numerical techniques will be presented as well as several examples. The house heating and air condition optimal strategies responded to different IPCC climate change scenarios for some domains of Russia are considered. Evolving of climate and energy costs should be taken into account in building construction design. Optimal relationship between future expenses for house heating and costs of new house constructions including material costs and its amounts is a subject of discussion. In both considered tasks DM might be performed by means of the discrete optimization algorithms. If the DM variables are all required to be integers, then the problem is called an Integer Programming (IP). The 0-1 IP is the special case of integer programming where variables are required to be 0 or 1 (rather than arbitrary integers). The IP is a most convenient form for decision maker use. The 1 value means that a given scenarios is accepted, the 0 value means that a given scenarios is rejected. To illustrate suggested approach the branch and bound technique was implemented to surface air temperature Ensemble Predictions System (EPS) for northern parts of Russia. Aim of this illustrative research was to link the EPS output facility to requirements of particular forecast users.

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