Abstract

In many real-life decision-making problems, the decision makers solve the problems which depend on parameters and these parameters are mostly unknown. Such type of decision-making problems appear in different disciplines. These problems are quite difficult to be modeled and solved, both conceptually and numerically. In these cases, the unknown parameters are handled by the uncertainty of the parameter. The uncertainty of these parameters arises because of many reasons like relevant data being in-existent or scarce, difficult to be obtained or estimated, the system being subjected to changes etc. One of these kinds of parameter is expressed by multi-choice parameter. Multi-choice programming (MCP) is a mathematical programming problem, in which the decision maker is allowed to set a multiple numbers of values for a parameter. Multi-choice programming problems are very hard to solve directly and computationally expensive. Under this situation, the main idea of the present work is to establish the solution procedures for some mathematical programming problems with multi-choice parameter.

During the formulation of a mathematical programming problem, we need to take care of several parameters namely cost coefficients, technological coefficients, resource limits. The present thesis highlights the formulation of some mathematical programming model considering all of these parameters as multi-choice type parameters. To tackle these multi-choice parameters, we use Lagrange's interpolating polynomials and then develop the solution procedures. A solution methodology is developed for bi-level and multi-level linear programming problem where all of its input parameters are multi-choice parameters. Further, a solution procedure is developed for linear fractional programming problem with multi-choice parameters.

The alternative values of a multi-choice parameter may not be deterministic always. Instead, these alternative values are random variables or fuzzy variables. For the first case, we call the parameter as multi-choice random parameter and the later one is called as multi-choice fuzzy parameter. A methodology based on chance-constrained programming is presented to solve the probabilistic linear programming problem with multi-choice random parameter. Considering the random variables present in the problem as independent normal random variables with known mean and variance, the solution procedure is presented. Possibility theory based approach is presented to solve the multi-choice fuzzy linear programming problem. The triangular and trapezoidal fuzzy numbers are considered in the problem. Some numerical examples are provided to illustrate the proposed models and methodologies to solve the problems.

Keywords: Linear Programming, Multi-choice Programming, Bi-level and Multi-level Programming, Fractional Programming, Chance-Constrained Programming, Multi-objective Programming, Fuzzy Programming