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Solving multi-choice linear programming problems by interpolating polynomials

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ABSTRACT

Multi-choice programming solves some optimization problems where multiple information exists for a parameter. The aim of this paper is to select an appropriate parameter from a set of multiple choices, which optimizes the objective function. We consider a linear programming problem where the right hand side parameters are multi-choice in nature. In this paper, the multiple choices of a parameter are considered as functional values of an affine function at some non-negative integer nodes. An interpolating polynomial is formulated using functional values at non-negative integer nodes to take care of any multi-choice parameter. After establishing interpolating polynomials of all multi-choice parameters, a mathematical programming problem is formulated. The formulated problem is treated as a nonlinear programming problem involving mixed integer type variables. It can be solved by using standard nonlinear programming software. Finally, a numerical example is presented to illustrate the solution procedure.

1. Introduction

In Operations Research (OR), a real life decision making problem is transformed into a mathematical model that attempts not only to explain the behavior of the system but also to find an optimal solution of that system. A Mathematical Programming (MP) problem is an optimization problem where we maximize/minimize one or more mathematical functions, known as objective functions subject to certain constraints imposed on the problem, which are represented by mathematical equations or inequalities with some restrictions on the decision variables. An MP problem is often extended over a parameter space p.

The mathematical model of such an optimization problem can be represented as

$$\max / \min : f(X; p) \tag{1.1}$$

subject to

$$g(X; p) \leq 0 \tag{1.2}$$

$$X \geq 0 \tag{1.3}$$

where $X \subset R^n$ and the functions f and g are defined as $f, g : R^n \to R$.

If we consider the linearity of the functions f and g, then the MP problem can be divided into two different problems, namely, linear and nonlinear optimization problems. Similarly, some known subsets of the MP problem are called constrained and unconstrained optimization (depending on the presence or absence of constraints), single objective and

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