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MULTI-LEVEL INTEGER PROGRAMMING PROBLEM WITH MULTIPLE OBJECTIVES AT EACH LEVEL

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ABSTRACT

A Multi-Level Programming Problem (MLPP) is a hierarchical optimization problem where the constraint region of the first level is implicitly determined by the other optimization problems. In this paper, an integer multi-level programming problem is considered. At each level, there are multiple objective functions which are linear fractional and the feasible region is assumed to be a convex polyhedron. Here, the variables are bounded. An algorithm is developed for ranking and scanning the set of feasible solutions. These ranked solutions are used to find the efficient solution of Multi-Level Linear Fractional Programming Problem (MLFFPP). An example is illustrated and solved using LINGO 17.

KEYWORDS: Linear fractional programming problem, integer programming, multi-level programming, efficient solution, bounded variables, multi-objective programming.

MSC: 90C10, 90C29, 90C32

RESUMEN

A multi-level integer linear fractional programming problem with bounded variables is considered. The multiple objective functions at each level are linear fractional. To find the set of efficient solutions for this multi-level programming problem, a mathematical model is evolved. This model scans the feasible region to find the efficient integral points. A solution procedure has been developed describing the above model. A numerical example is illustrated which is also solved by the software LINGO 17.

PALABRAS CLAVE: Problema de programación lineal fraccional, programación entera, programación multi-nivel, eficiente solución, variables acotadas, programación multi-objetivo.

1. INTRODUCTION

A Multi-Level Programming Problem (MLPP) deals with decentralized planning problems with multiple decision makers in a multi-level or hierarchical organization where decisions have interacted with each other. Herein, at each level, attempts are made by each decision maker to optimize their objective functions. In this process, it is also affected by the actions of the other decision makers. Distinct solution methodologies for multi-level programming problem and its applications have been analyzed by various authors. Candler et al. [11] in 1981, discussed the role of multilevel programming in agricultural economics. Bard and Falk [4] in 1982, proposed an explicit solution to the multi-level programming problem. In 1988, Anandalingam [3] proposed a model of decentralized multi-level systems. In 1992 [7], Blair discussed the computational complexity of multi-level linear programs. Pramanik and Roy [28] in 2007, solved multilevel problems by fuzzy goal programming approach. In 2015, Liu and Yao [21] applied genetic algorithm to solve uncertain multilevel programming problem. In 2016, Kassa [18] gave a branch and bound multi-parametric

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