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POSSIBILISTIC PROGRAMMING DECISION PROBLEMS WITH PRIOR GOALS

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Abstract. *In this paper, an upper level decision problem is formed by a set of possibilistic constraint conditions with possibilistic ideal goals of decision variables given by a decision maker. Possibilistic programming decision problems are proposed to obtain the possibilistic decision which approaches the possibilistic ideal goals as much as possible subject to possibilistic constraints. Two possibility distributions are considered for reflecting the inherent uncertainty in the decision problem. The possibilistic programming problems can be converted into conventional quadratic programming problems. The analysis results show that the proposed methods are effective for upper level decision problems under uncertainty which are extensively encountered in business and economics.*
Keywords: Decision making, Possibility distribution, Possibilistic programming problem, Quadratic programming problem

1. **Introduction.** For some considerable time, linear programming (LP) has been one of the important operation research approaches, which has been widely used and gained many achievements in both applications and theories. It is well-known that the data used in LP must be well defined and precise. Such requirement is often impossible for real decision making problems. For handling the imprecision in the parameters of an LP model, a post-optimization analysis with the help of sensitivity analysis and parametric programming is often used. However, none of these methods is suitable for an overall analysis of the effects of imprecision in parameters. Another way to deal with the uncertainty existing in the parameters in an LP model is to resort stochastic programming problems where the uncertainty is characterized by probability distributions [12]. The other way to cope with the uncertainty in LP problem is using fuzzy set theory, which gives the conceptual and theoretical framework for dealing with complexity, imprecision and vagueness [1,2,5,7,17].

Generally speaking, in fuzzy linear programming models, the coefficients of decision variables are fuzzy numbers while decision variables are crisp ones. This means that in an uncertain environment, a crisp decision is obtained to be satisfied with some decision criteria. On the other hand, Tanaka et al. [13] initially proposed a possibilistic linear programming formulation where the coefficients of decision variables are crisp while decision variables are characterized by possibility distributions. As a remarkable extension of this study, non-interactive and interactive possibility distributions of fuzzy decision variables are considered in the paper [15]. In the literature [4], a concept of "soft equal" is introduced. A decision problem is considered to obtain the upper and lower possibility distributions of decision variables from a set of possibilistic constraints which describe a kind of "approximate satisfaction" offered by decision makers. In the literature [3],