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Comment on LINGO Package for Multi-objective Linear Programming Problems

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Abstract

Multi-objective programming models involve optimization of several conflicting objective functions with constraints. In this paper, we claim and prove that there is a major typographical error in a particular paragraph of the article by S. Javaid et al. (Multi-objective stochastic linear programming problem when bi's follow Weibull distribution, Journal of Operational Research Society of India OPSEARCH, 2013, pp. 250-259) over the use of LINGO package for obtaining compromise optimal solution of a multi-objective programming problem. LINGO package cannot be used in obtaining the compromise optimal solution of multi-objective linear programming problems (MOLPPs). The proposed comment and correction will be useful in order to avoid confusion over the use of LINGO package and development of new techniques for MOPPs.

Keywords: Multi-objective optimization, Stochastic programming, LINGO software, Compromise optimal solution, Weibull distribution.

1. Introduction

Multi-objective programming problems concern optimization of several conflicting objective functions with constraints. Decision-making problems such as production planning, water resource management etc. involve multiple conflicting objectives with constraints and can be described by multiple objective programming models. Numerous methods for multi objective optimization problems have been suggested by researchers in literature.

Multi-objective stochastic (or probabilistic) programming deals with situations of optimizing conflicting objective functions where some or all the parameters of the

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optimization problem are described by probability (or random) variables rather than by deterministic one. The basic idea in stochastic optimization is to convert the stochastic model into an equivalent multi-objective deterministic model.

Recently, S. Ansari *et al.* [1] presented an algorithm for a multi-objective probabilistic programming problem when right hand side vector follows Weibull distribution. In their proposed algorithm, multi-objective probabilistic problem is converted into an equivalent deterministic multi-objective model and further solved using LINGO software. In the numerical example section of this paper, the final reduced deterministic multi-objective programming model is given as:

$$Max\, Z_1 = 3x_1 + 3x_2$$

$$Max\, Z_2 = 5x_1 + 2x_2$$

$$\begin{aligned} \text{Subject to,} \quad & 2x_1 + x_2 \le 20.6492 \\ & x_1 + 2x_2 \le 20.4530 \\ & x_1 \ge 0, x_2 \ge 0. \end{aligned} \tag{1}$$

The compromise optimal solution as obtained in S. Ansari *et al.* [1] using LINGO package is as follows:

$$x_1^* = 9.4038, x_2^* = 1.8415, Z_1^* = 33.3761, Z_2^* = 50.7022.$$

Here we noticed that there is a major typographical error in this paragraph related to the use of LINGO package which states that this problem (1) can be solved using goal programming or fuzzy programming or LINGO package. But LINGO package cannot be used in obtaining optimal solution of such programming problems.

If we consider detailed information about LINGO package, we observe that LINGO is a basic software tool designed to efficiently build and solve linear, nonlinear, and integer optimization models. It is developed by LINDO Systems Inc. and key features of LINGO are available on the LINDO Systems web site www.lindo.com

Here we can observe that LINGO does not deal with multi-objective programming problem and does not provide any efficient solution or compromise optimal solution to the multi-objective programming problem. Even, LINGO provides a variety of error messages useful for debugging a developing model. The most common error for multi-objective programming problem includes the following:

- 68: Multiple objective functions in model
- Only one is allowed, please.

If we consider the same numerical example (1) and try to solve this with LINGO package (trial version used for illustration), then we will have an error code 68 (as shown in figure 1) which indicates the limitation of package to solve multi-objective programming problems.

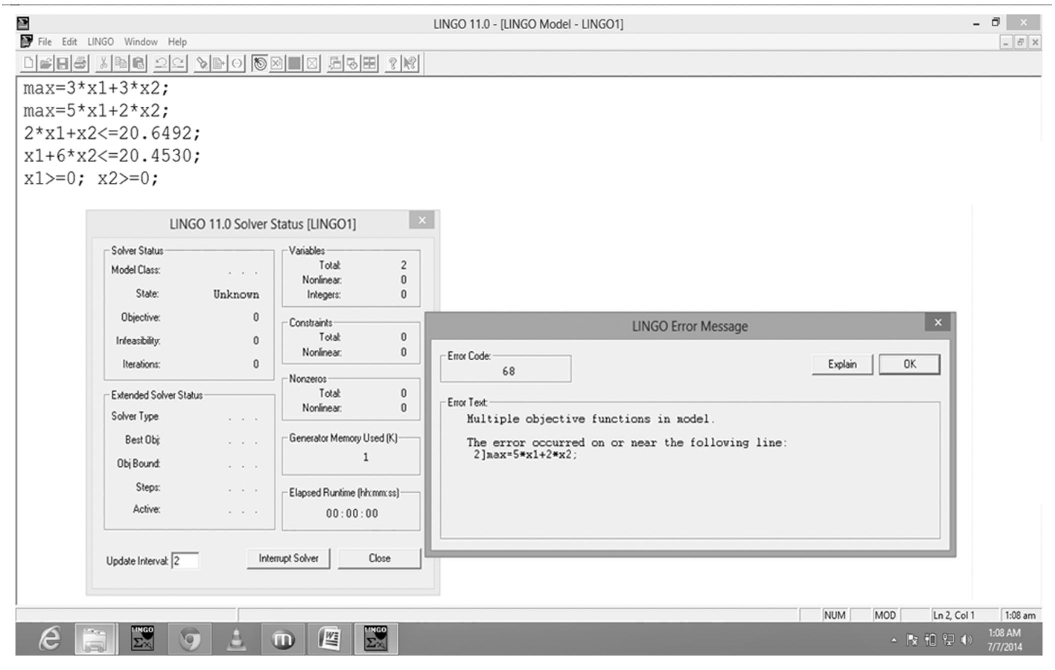

Figure 1: *Use of LINGO package (trial version) for multi-objective programming problem*

This verifies that LINGO package cannot be use to obtain compromise optimal solution of multi-objective programming problems and simultaneously it proves that there is a major typographical error this paragraph of S. Ansari *et al.* [1] in obtaining compromise optimal solution by LINGO of numerical example section. Therefore it is proposed that the third paragraph of numerical example section of article by S. Ansari *et al.* [1] which states that "This problem can be solved using goal programming or fuzzy programming method or LINGO package" should be corrected with "This problem can be solved using goal programming or fuzzy programming method with the help of LINGO package after converting the problem compatible for LINGO package".

2. Conclusions

In this paper, we comment on the use of LINGO package for multi-objective programming problems by Javaid *et al.* [1] and present limitation of LINGO for multi-objective programming problems. The proposed comment and correction will be useful in the development of new techniques and methodologies for multi-objective programming problems with the use of appropriate software tools.

References

[1] Ansari SI, Anwar Z, Javaid S (2013) Multi-objective stochastic linear programming problem when b_i's follow Weibull distribution. OPSEARCH 50(2): 250-259.