Comparative Summary of NLP Solvers: GAMS and MOTAD.

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Contents

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Abstract

In this paper, we will perform and produce a comparative study between two NLP solvers, namely GAMS and Motad. The introductions of both modelling systems will be illustrated. Also, contrasts between these systems will be presented.

Introduction to GAMS

GAMS stands for General Algebraic Modelling System. Both linear and non-linear problems can be solved by using GAMS. This system has the capabilities of working with huge and complex modelling applications. With the assistance of GAMS, the user can build adaptive models of great sizes.

The website www.gams.com provide valuable data regarding the system. Some key points are mentioned below.

- The General Algebraic Modelling System (GAMS) is an evolved and mature system that gives the user access to cutting-edge modelling and optimization technology.
- The website also states that technical support is provided by a team of Ph.D. level optimization and modelling experts.

The website states (and describes) real world models like the following :-

1) Transportation Planning: Finding the optimal way to distribute goods between different sites.

2) Route Planning: Finding the shortest route through multiple cities.

3) Production Planning: To decide how much to produce based on demand and prices for production and stocking.

4) Scheduling: To minimize total processing time for sequential assembly steps.

5) Blending: To calculate the optimal mixture of different ingredients to produce a product of desired quality.

6) Cutting Stock: To minimize waste when cutting stock into smaller pieces.

GAMS was developed at the time and out of necessity, when the mathematical programmers were not satisfied with the low reliability and low efficiency of optimization tools. In addition, high costs of these optimization tools was a big factor contributing towards their disappointment. Thus, the GAMS was designed to solve linear as well as non-linear problems. It also made it possible to move the models from one platform to another, thus making the system portable.

Introduction to MOTAD.

MOTAD stands for Minimization of Total Absolute Deviations. It can be visualized as an extension of linear programming to handle risks. Basically, defining the MOTAD model as a risk constrained Linear programming model. Most risk-programming applications in agriculture are based on MOTAD decision criteria (Loren W. Tauer, 1983).

The MOTAD model can be utilized to solve the problems related to following areas:

1) Risk and uncertainty in agriculture.

2) Measurement of risk

3) Adjustment to risk.

4) Taking weather uncertainty into account while decision making.

MOTAD uses the same input-output tableau as the LP models, but in addition to constraints like absolute deviation of revenue, probabilities or income deviation in order to calculate the mean absolute deviation. The model is solved with mean absolute deviation set to a random high value which is then iteratively reduced until no better solutions are found.

The MOTAD was designed during a time period where quadratic programming was not considered feasible for even medium sized problems. The results provided by MOTAD have an accuracy of 88%. Peter Hazell says, MOTAD uses an estimator which is only 88% efficient and hence, the results cannot be as reliable (Peter Hazell, 1971).

Contrasts between GAMS and MOTAD.

Reviewing superficially, GAMS and MOTAD both are solver systems capable of modelling and solving linear and non-linear problems. By assessing further, we can discover many differences in the nature and working of both the systems.

GAMS was developed as a solver system which can build adaptive models. Whereas, the MOTAD is better at modelling when there are a lot of risks involved. MOTAD model is better adapted for post-optimality analysis (Peter Hazell, 1971). Most risk-programming applications in agriculture are based on MOTAD decision criteria (Loren W. Tauer, 1983). It has better application and association to non-normal cases (Thomson and Hazell). On the other hand, GAMS proved to be helpful in the areas of chemical engineering, economics, finance and related fields.

As compared to GAMS, MOTAD uses additional constraints namely, absolute deviation of revenue.

Conclusion.

This study emphasizes the concepts of GAMS and MOTAD. Major applications of both the NLP solvers were presented. Also illustrated were the backgrounds of the same. The differences in GAMS and MOTAD were presented. A sequel to this study would be the comparative study between GAMS and Target MOTAD, which is the modification of the original MOTAD.

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