Decision Optimizer 7.0: A novel approach to optimization modelling

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Decision Optimizer is a modelling platform which empowers non-OR professionals with a graphical and easy to use interface to create optimization problems and solve them efficiently. It offers a unique paradigm to accelerate the development of optimization applications using an OR-based toolset, as compared to more traditional approaches relying on general purpose programming languages. Currently it allows users to create Generalized Assignment Problems without any prior knowledge of combinatorial optimization; automatically integrating input data, equations, analytic artefacts and decisions into an optimization problem. This innovative approach in model development is also used to graphically depict complex decision processes, facilitating the cooperation between the various project stakeholders (executives, business analysts, IT engineers) through the use of a standard UML-like diagramming process tailored to optimization problems.

The software is used in a variety of settings, ranging from calculating complex functions, simulating business as usual processes or optimizing decisions, offering a convenient step-by-step process to discover customer requirements, undertake comparative scenario analysis, and develop out the chosen scenario as deployable decision logic.

1 Introduction

As a first step, DO reads in CSV files and automatically extracts column types and field statistics. It also provides functionality to repair the CSV file by ignoring or replacing erroneous or wrong values. The content of the file is then readily made available to the end user who can start designing his decision process and writing equations.

The design of the directed acyclic graph that represents the decision process occurs in a graphical environment presented in the [Figure 1]. Each node either represent an input file or a computation. The arcs are used to describe the dependency between the calculations. The graph format is an extension of the Decision Modelling Notation[1] and provides a unique view of the process that can easily be shared across all stakeholders.

The calculation nodes are associated with files that are used as lookup tables, predictive models, or equations. Once a component has been associated with a node of the DIM graph, DO will verify and automatically maps its inputs to the input data or any upstream calculations. The user can then focus on writing equations without worrying about indices.

The user selects the calculations he wants to persist and the values he wants to use for reporting. A database containing all these information, along with a set of predefined reports are then made available for each scenario run.

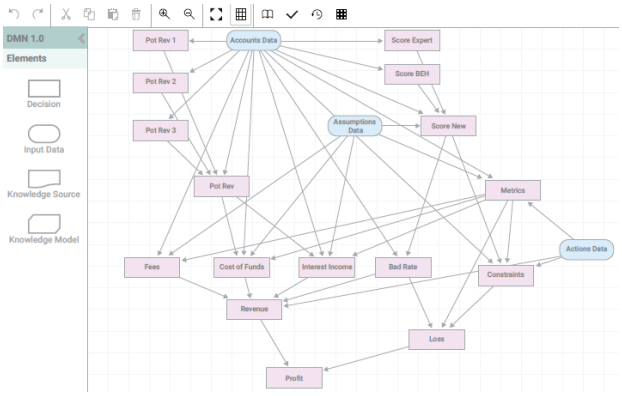

FIG. 1 – Example of a Decision Impact Model

2 Creating the Model of the Problem and the Solver

When setting up the project, the user describes all possible decisions that needs to be explored during optimization. He also describes limits on the various outputs that are produced by the components in order to create global constraints. These information are combined with the data dimensions to produce a generalized assignment problem.

Recent advances in mixed integer optimization solvers[2] allow us to solve real world problems of this type in minutes, even for large-scale instances with (tens of) millions of decision variables.

2.1 Tree Aware Optimization

Tree Aware Optimization is a restriction of the GAP optimization problem which consist in generating a decision tree[3]. When it comes to implementing the decisions produced by an optimization solver, it is often easier to use a simple format like a decision tree rather than having to deploy a general purpose optimization solver in a production environment. Moreover in highly regulated domains like banking and finance, optimization solvers are not as easily auditable as a simple tree.

3 Conclusion

Decision Optimizer 7.0 represents an innovative approach to solving optimization problems, made possible by the availability of a single software platform that combines a modern user interface, graphical modelling, and an advanced MIP solver.

References

[1] G. Terry Ross and Richard M. Soland, A branch and bound algorithm for the generalized assignment problem. *Mathematical Programming*, Volume 8, Issue 1: 91–103, 1975.

[2] Xpress Optimization Suite, release 8.0.

[3] K. P. Bennet, Decision tree construction via linear programming. *Proceedings of the 4th Midwest Artifical Intelligence and Cognitive Science Society Conference*, 1992, 97-101.

[4] Object Management Group, Decision Model and Notation (DMN), v1.1. *http://www.omg.org/spec/DMN/1.1*