Goal Programming

James P. Ignizio
Resource Management Associates

Carlos Romero
Technical University of Madrid

GLOSSARY

achievement function The function that serves to measure the achievement of the minimization of unwanted goal deviation variables in the goal programming model.

goal function A mathematical function that is to be achieved at a specified level (i.e., at a prespecified "aspiration" level).

goal program A mathematical model, consisting of linear or nonlinear functions and continuous or discrete variables, in which all functions have been transformed into goals.

multiplex Originally this referred to the multiphase simplex algorithm employed to solve linear goal programs. More recently it defines certain specific models and methods employed in multiple- or single-objective optimization in general.

negative deviation The amount of deviation for a given goal by which it is less than the aspiration level.

positive deviation The amount of deviation for a given goal by which it exceeds the aspiration level.

satisfice An old Scottish word referring to the desire, in the real world, to find a practical solution to a given problem, rather than some utopian result for an oversimplified model of the problem.

GOAL PROGRAMMING, a powerful and effective methodology for the modeling, solution, and analysis of problems having multiple and conflicting goals and objectives, has often been cited as being the "workhorse" of multiple objective optimization (i.e., the solution to problems having multiple, conflicting goals and objectives) as based on its extensive list of successful applications in actual practice. Here we describe the method and its history, cite its mathematical models and algorithms, and chronicle its evolution from its original form into a potent methodology that now incorporates techniques from artificial intelligence (particularly genetic algorithms and neural networks). The article concludes with a discussion of recent extensions and a prediction of the role of goal programming in real-world problem solving in the 21st century.

I. INTRODUCTION

A. Definitions and Origin

Real-world decision problems—unlike those found in textbooks—involve *multiple,* conflicting objectives and goals, subject to the satisfaction of various hard *and soft* constraints. In short, and as the experienced practitioner is well aware, problems that one encounters *outside* the classroom are invariably massive, messy, changeable, complex, and resist treatment via conventional approaches. Yet the vast majority of traditional approaches to such problems utilize conventional models and methods that idealistically and unrealistically (in most cases) presume the optimization of a single-objective subject to a set of rigid