EXPANDING AND PRESENTING CERTAIN ESSENTIAL MOILPS-RELATED NOTATION AND CONCEPTS TO MAKE A PRESENTATION

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Abstract
In this article, we discuss a few techniques to multi-objective linear programming in various fields of integer programming. The fundamental idea behind these precise methods is presented. Involve many to be reduced or maximized goal functions. Answer is a collection of options that outlines the ideal compromise between conflicting goals.
Keyword: Multi-Objective Integer Linear Programming, Optimization Techniques.

INTRODUCTION

PRELIMINARIES AND PROBLEM FORMULATION

To make the presentation and discussion of subsequent sections easier, we expand and explain certain required notation and concepts related to MOILPs in this section. Let n-vectors make up c1 and c2. A MOILP can be launched as follows if A is an m-vector and b is an m-n matrix:

$$\max_{x \in X}\{z^1(x), z^2(x) \ldots\ldots z^n(x)\}$$

Where: {x n+: Ax ≤ b} represent the feasible set in the decision space, and ( ) := c1 and ( ) := c2 are two linear objective functions. Note that n+:= {s n : s ≥ 0}. The image Y of X under vector-valued function z = (z1, z2) represent the feasible set in the objective / criterion space, i.e., Y:= z(X) := {y 2 : y = ( ) for some X }. It is assumed that X is bounded, and all coefficients / parameters are integer, i.e., A m×n , b m . ci n for i = 1,2…n.

DOMINANCE

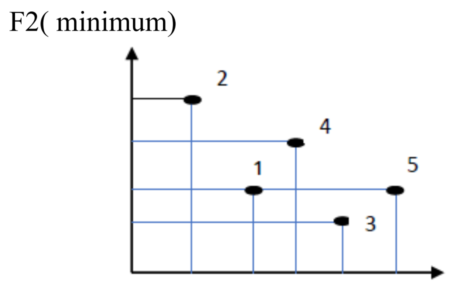
In the single-objective optimization problem, the superiority of a solution over other solutions is easily determined by comparing their objective function values. In multi-objective optimization problem, the goodness of a solution is determined by the dominance.

DEFINITION OF DOMINANCE

Dominance Test: dominates , if Solution is no worse than in all Objectives. Solution is strictly better than in at least one objective.

x1 dominates x2 ↔ x2 is dominated by x1 .

Example of Dominance Test:



F2(maximize)

- 1 Vs 2: 1 dominates 2
- 1 Vs 5: 5 dominates 1
- 1 Vs 4: Neither solution dominates.

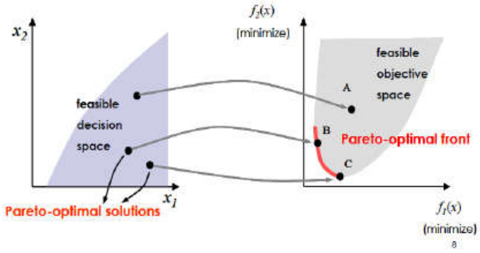
PARETO OPTIMAL SOLUTION:

Non-dominated solution set: Given a set of solution, the non-dominated solution set is a set of all the solution that are not dominated by any member of the solution set.

The non-dominated set of the entire feasible decision space is called the Pareto Optimal set.

The boundary defined by the set of all point mapped from the Pareto optimal set is called the Pareto optimal front.

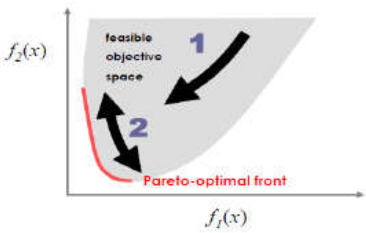
GRAPHICAL DEPICTION OF PARETO OPTIMAL SOLUTION:



GOALS IN MULTI-OBJECTIVE OPTIMIZATION:

Find set of solution as close as possible to Pareto optimal front

To find a set of solution as diverse as possible



WEIGHTED SUM METHOD:

Scalarize a set of objectives into a single objective by adding each objective pre-multiplied by a user-supplied weight.

$$\text{Minimum } F(x) = \sum_{m-1}^{M} w_m f_m(x),$$
$$\text{Subject to } g_j(x) \geq 0, \qquad j = 1,2,\dots,j$$
$$h_k(x) = 0, \qquad k = 1,2,\dots,k$$
$$x_i^{(L)} \leq x_i \leq x_i^{(U)}, \quad i = 1,2,\dots,n$$

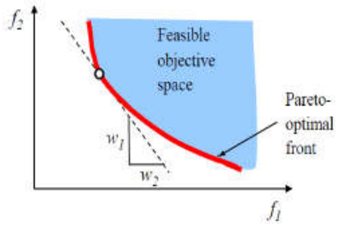
Weight of an objective is chosen in proportion to the relative importance of the objective.

Advantage: it is simple

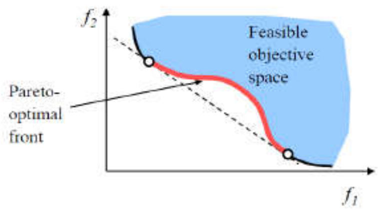
Disadvantage: it is difficult to set the weight vectors to obtain a Pareto-optimal solution in a desired region in the objective space.

It cannot find certain Pareto-optimal solution in the case of a nonconvex objective space.

WEIGHTED SUM METHOD (CONVEX CASE):



WEIGHTED SUM METHOD (CONVEX CASE):



E-CONSTRAINT METHOD:

Haimes *et.al.*1971, It keeps just one of the objectives and restricted the rest of the objective within user-specific values.

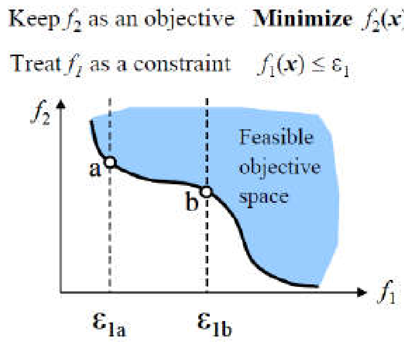
Minimum $f_\mu(x)$,

Subject to $f_m(x) \leq \varepsilon_m$, $\quad m = 1,2,\dots,M$ and $m \neq \mu$

$g_j(x) \geq 0, \quad j = 1,2,\dots,j$

$h_k(x) = 0, \quad k = 1,2,\dots,k$

$x_i^{(L)} \leq x_i \leq x_i^{(U)}, \quad i = 1,2,\dots,n$



Advantage: applicable to either convex or non-convex problems.

Disadvantage: The ε vector must be chosen carefully so that it is within the minimum or maximum values of the individual objective function.

CONCLUSION

In this article paper we conclude that the sort form different methods of multi-objective linear programming in this field of optimization technique.

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