

MULTI-OBJECTIVE PROBLEMS

I will be working on a Knapsack problem with 2 objectives and 3 constraints. Consider decision variables as nonnegative integers, not as binary variables. In other words, put an item more than once to the Knapsack.

I will be using EpsilonConstraintMethod.xlsx in this assignment. Check sheet “Knapsack Problem” for the objectives and constraints. For the solution part, I am finding all the efficient points by using epsilon constraint method by taking first objective as the only objective. While solving the optimization problem, I am using Excel Solver, i.e. for each epsilon Excel Solver is called in my VBA code and find the optimal point. I will also provide epsilon values and objectives for each iteration. Take the epsilon at each iteration as 1.

ε Constraint Method

Procedure:

The epsilon constraint method is one of the best methods to solve multi objective problems.

Step 1:

Assign one of the objectives as the only objective and turn the other objective into a constraint in the following manner;

If you turn a minimization objective into a constraint, use $Ax_1 + Bx_2 < \epsilon$ structure

Or if you turn a maximization objective into a constraint, use $Ax_1 + Bx_2 > \epsilon$ structure.

Step 2:

Initially assign epsilon its upper or lower bound. Find the optimal solution x_0 .

Step 3:

Decrease or increase ϵ with a small amount, i.e. small amount in a way that you will be excluding the points found in previous steps in your feasible area. Find the optimal solution, for alternative solutions arbitrarily choose one of them.

If you found an infeasible solution, stop the procedure. If not go to Step 4.

Step 4:

Store optimal solution as x_i . Go back to Step 3. By systematically changing ϵ value, you may find, sometimes all, efficient solutions from x_0 to x_i .