

Computation of Problems Involving in Linear Programming

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ABSTRACT: This paper includes development of various method of implementing the computer programs. The testing involved structured problems based on linear programming models from various applications. Some results on existing operators along with these new operators are presented.

I. INTRODUCTION

A linear programming problem is a special case of a mathematical programming problem. From an analytical perspective, a mathematical program tries to identify an extreme point of a function, which furthermore satisfies a set of constraints[7].

Linear programming is the specialization of mathematical programming to the case, where both function f , called the objective function, and the problem constraints are linear. Mathematical programming is an optimisation tool, which allows the rationalization of many managerial and/or technological decisions required by contemporary applications. An important factor for the applicability of the mathematical programming methodology in various contexts is the computational tractability of the resulting analytical models[1].

The advent of modern computing technology means that effective and efficient algorithmic procedures exist, to provide a systematic and fast solution to these models[6]. For linear programming problems, the Simplex algorithm provides a powerful computational tool, able to provide fast solutions to very large-scale applications, sometimes including hundreds of thousands of variables.

Max $Z = cTx$

Where c is an n -dimensional constant vector and x is an n -dimensional variable vector subject to m inequality constraints of the form $a_jT x \leq b_j, j = 1, 2, \dots, m$.

$x_i \geq 0$.

Definition

A feasible solution is an element $x [2] \in R^n$ which satisfies the constraints

$Ax = b$, and $x \geq 0$.

Among all solutions of the equation $Ax = b$, certain ones are called basic.

Definition

Let B be any $m \times m$ non-singular submatrix of A consisting of linearly independent columns of A . Then if the $n - m$ components of a solution x corresponding to the columns of A which do not appear in B are set equal to zero, the solution, $Xb[5]$, of the resulting set of equations is said to be a basic feasible solution with respect to the basis consisting of columns of B . The components of x_B associated with the columns of B are called the basic variables.

II. THEOREM

If a linear programming problem has a solution, then it must occur at a vertex, or corner point, of the feasible set, S , associated with the problem. Furthermore, if the objective function P is optimized at two adjacent vertices of S [3], then it is optimized at every point on the line segment joining these two vertices, in which case there are infinitely many solutions to the problem.

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Problem:

Evaluate the objective function, P, at each vertex. The maximum (if it exists) is the largest value of P at a vertex. The minimum is the smallest value of P at a vertex. If the objective function is maximized (or minimized) at two vertices, it is minimized (or maximized) at every point connecting the two vertices.[4]

Example: Find the maximum and minimum values of $P=5x+7y$ subject to

$$6x + 3y \leq 50$$

$$4x + 2y \leq 60$$

$$x \geq 0, y \geq 0$$

Example: Maximize $f=3x+2y$ subject to

$$x+y \leq 4$$

$$-2x+y \leq 2$$

$$x \geq 0, y \geq 0$$

Introduce a slack variable into each inequality to make an equation. Rewrite the objective function into an equation:

$$x + y + u = 4$$

$$-2x + y + v = 2$$

$$-3x + 2y + f = 0$$

Set up the initial simplex tableau:

$$\begin{array}{cccc|c} x & y & u & v & f \\ 1 & 1 & 1 & 0 & 0 & 4 \\ -2 & 1 & 0 & 1 & 0 & 2 \\ -3 & -2 & 0 & 0 & 1 & 0 \end{array}$$

What are the values of our variables here? Remember, a column that is not a unit column (one 1 and the rest zero) is a non-basic variable and is equal to 0. We find the following:

$$x=0, y=0, u=4, v=2 \text{ and } f=0.$$

Look now at the feasible region. This point is at the origin. Can we increase f ? Yes, and changing x [8]

will increase it fastest. So we want to pivot on the x column. Look at the quotients. Only one is possible. So we will pivot on the first row. Use the calculator program SMPLX. What we find is

$$\begin{array}{cccc|c} x & y & u & v & f \\ 1 & 1 & 1 & 0 & 0 & 4 \\ 0 & 3 & 2 & 1 & 0 & 10 \\ 0 & 1 & 3 & 0 & 1 & 12 \end{array}$$

The values of the variables $x=4, y=0, u=0, v=10$, and $f=12$.

We have moved to the corner point (4,0). We couldn't have moved

to the other corner point on the x -axis as it is out of the feasible region (that's what the negative number would cause. By choosing the smallest non-negative quotient we move to a corner of the feasible region, not just any intersection point.

III. CONCLUSION

Included the development of various methods of computer program problems. Structured problems based on linear programming models from various applications were reviewed.

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