

عنوان البحث

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**Abstract**

Maximize the profit, Minimize the cost. These all I could say about Linear Programming. As all companies are seeking to improve their products but with constrains. These improvements should accomplish goal which is to make the most of their equipment, materials and their stuff employees. They are also looking after achieving an annual income that is to be off course more than the previous year.

**Introduction**

The need to get the ‘best’ out of a system is a very strong motivation in much of

engineering. A typical problem may be to obtain the maximum amount of product or to

minimize the cost of a process or to find a configuration that gives maximum strength.

Sometimes what is ‘best’ is easy to define, but frequently the problem is not so clear

cut, and a lot of thought is required to reach an appropriate function to optimize. In most

cases there are very severe and natural constraints operating: the problem may be one

of maximizing the amount of product, subject to the supply of materials; or it may be

minimizing the cost of production, with constraints due to safety standards. Indeed,

much of modern optimization is concerned with constraints and how to deal with them.

We will discuss two methods that could be used to solve this kind of problems. First one is the graphical method in which the solution is attained by constructing the domain of the solution from the inequalities after changing them into equalities. The second method is the simplex method which is an iterative procedure and a technique developed to solve linear programming problems. Then we will touch the surface of the dual problems.

**Research Project Contents**

The main problem of linear programming

1.1 The main problem of Linear programming is the minimization on the maximization of a linear function subject to linear constraints. The function whose greatest or least value is being sought is called an objective function and the collection of the value of the variables at which the greatest or the least value is attained defines the so called optimal plan Any other collection of vines complying with the restrictions defines the feasible plan solution)

Assume that the constraints are given in consistent system of m linear inequalities in n variables

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It is required to choose among the non-negative solutions of the system as a result of which the linear (objective) function

Assumes the greatest (the least) value or, as they say, it is required to maximize minimize the linear form L.

We shall show now how to solve this problem by a geometrical method for which purpose we shall consider a consistent system of linear inequalities in two and three variables. Suppose we are given, in addition, the linear function

Let us choose from among the set of points () belonging to the domain e solutions of the consistent system of inequalities such points which import to the given linear function the least (the greatest value. For each point of the plane the function L assumes a fixed value L=L The set of all sulci points is the straight line

perpendicular to the vector Color) wlich starts at the origin if we move this live parallel to itself in the positive direction of the vector C. then the linear function

will increase, and if we move the line in the opposite direction it will decrease suppose that when the line moves in the positive direction of vector C. it first

comes across the polygon of the solutions at its vertex and then, being in the position

L1; the line L becomes supporting, and on this line the function L assumes the least

value. In its further movement in the same (positive) direction, the straight line L

will pass through another vertex of the polygon of solutions, leaving the domain of

solutions, and will also become a supporting line L2 ; on that line, the function L

assumes the greatest value among all the values attained on the polygon of solutions.

Thus, minimization and maximization of the linear function

L = c1x1 + c2x2 + c0

on the polygon of solutions are attained at points of intersection of the polygon and

the lines of support perpendicular to the vector C(c1; c2): The line of support may

have either one point in common with the polygon of solutions (the vertex of the

polygon ), or an inÖnite set of points (this set being a side of the polygon).

By analogy with the aforesaid, the linear function of three variables

L = c1x1 + c2x2 + c3x3 + c0

assumes a constant value on the plane perpendicular to the vector C (c1; c2; c3):

The least and the greatest value of the function on the polyhedron of solutions are

attained at the points of intersection of the polyhedron and the planes of support

perpendicular to the vector C (c1; c2; c3): A plane of support may have either one

point in common with the polyhedron of solutions (its vertex), or an inÖnite set of

points (the set being an edge or a face of the polyhedron).

Example 1 Maximize the linear form

L = 2x1 + 2x2

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subject to the constraints

3x1 2x2 6;

3x1 + x2 3;

x1 3

Solution: Replacing the inequality signs of strict equalities, we construct the

domain of solutions from the equations of the straight lines

3x1 2x2 + 6 = 0;

3x1 + x2 3 = 0;

x1 = 3

The domain of solutions of the inequalities is the triangle MNP: Mow we construct

the vector C(2; 2): Then, when leaving the triangle of solutions, the line of support

passes through the point P(3; 15=2) and, therefore, at the point P the linear function

L = 2x1 + 2x2

assumes the greatest value, that is, is maximized, and Lmax = 2:3 + 2:(15=2) =

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Example 2 Minimize the linear function

L = 12x1 + 4x2

subject to the constraints

x1 + x2 2;

x1 1=2;

x2 4;

x1 x2 0

Solution: Replacing the inequality signs by the signs of strict equalities, we

construct the domain of solutions bounded by the straight lines

x1 + x2 = 2;

x1 = 1=2;

x2 = 4;

x1 x2 = 0:

The domain of solutions is the polygon MNP

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Next we construct the vector C(12; 4). The line of support passes through the point

M(1=2; 3=2); which is the Örst point of intersection of the polygon of solutions and

the line L on the way of the movement of that line in the positive direction of the

vector C: At the point M the linear function

L = 12x1 + 4x2

assumes the least value

Lmin = 12:(1=2) + 4:(3=2) = 12:

Example 3 Consider the problem

Maximize

f (x) = x1 + x2

Subject to

2x1 + x2 1

x1 2

x1 + x2 3

and

x1 0 x2

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Solution:

E

G

A

B

C

0

D

Here the polygon OABCD represents the set of feasible solutions and the objective

function has the same slope as the third constraint. The line Eg; x1 + x2 = 0 is

parallel to the face BC of the feasible region. Hence on shifting Eg parallel to itself

it will coincide with BC. Consequently any point on the bounding lineBC will

be optimal solution with the same maximum value for the objective function. In

this case we have an inÖnite number of optimal solutions the two points B and C

represents optimal extreme solutions.

B = (x1 = 2; x2 = 1)

C = (x1 = 1; x2 = 2)

and all the convex liner combination of these two points, i:e: all the points lying on

the line BC between B and C represent optimal solution. The optimal value of

the objective function will be f (x) = 3:

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1. maximize

f (x) = 5x1 + 3x2

subject to

3x1 + 5x2 15

5x1 + 2x2 10

and

x1 0; x2 0

2. Minimize

f (x) = 3x1 x2

x1 + x2 3

x1 x2 1

x2 2

and

x1 0 x2 0

3. Minimize

f (x) = 3x1 + x2

Subject to

x1 x2 1

x1 x2

**References**

Write the references of the research project in this part.

1. Reference 1.
2. Reference 2.
3. Reference 3.
4. Reference 4.
5. Reference 5.

المراجع: يكتب فيها أسماء المراجع المرتبطة بالمشروع البحثي بشرط لا تقل عن 5 مراجع وان يكون معظمها من بنك المعرفة المصري.