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The Real Life Application of Linear Programming Problem

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Introduction:

Linear Programming Problem is used to find the best or optimal solution to a problem that requires a decision or set of decisions about how best to use a set of limited resources to achieve a good goal of objectives. Linear Programming or Linear Optimization may be defined as the problem or maximization a linear function that is subjected to linear constraints. The constraints may be equalities or inequalities. The optimization problems involve the calculation of profit and loss. It is a method to achieve the best outcome (such as maximum profit and lower cost) in a mathematical model whose requirements are represented by linear relationships. The objective function should be specified quantitatively.

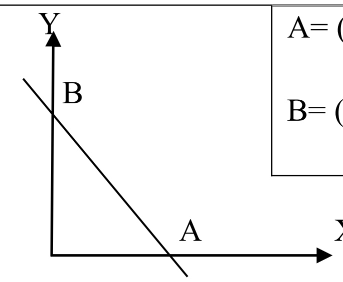
Some types of Linear Programming are as follows-

- To solve linear programs by graphical model
- To solve linear programming using „R" solve linear program using open solver

ax+by= c

— + — = –

_ + _ = 1



A= (_, 0)

B= (0, _)

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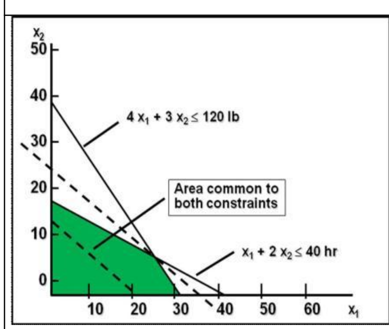
In the real world the problem is to find the maximum profit for a certain production. In „**REAL LIFE**" linear programming is part of a very important area of mathematics are called "**QUANTITATIVE TECHNIQUES**". Many real world problems lend themselves to linear programming modeling. Many real world problems can be approximately by linear models. There are well known successful applications in – manufacturing; marketing; finance (investment); advertising & agriculture.

History:

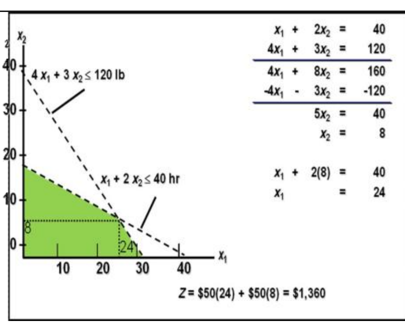
Year	Scientist	Remarks
1947	George B. ***Dantzig***	George Dantzig created a simplex algorithm to solve linear programs for planning and decision-making in large-scale enterprises. The algorithm's success led to a vast array of specializations and generalizations that have dominated practical operations research for half a century.
14th October, 1975	The Royel Sweden Academy of Science awarded the Novel Prize in economic science to L.V.Kantorovich & T.C.Koopmans	For their contributions to the theory of optimum allocation of resources.
1979	L.G.Khachian	The breakthrough in looking for a theoretically satisfactory algorithm to solve Linear Programming Problem.
1984	N. Karmakar	He developed algorithm is superior to the simple method.

Graphical Solution Method:

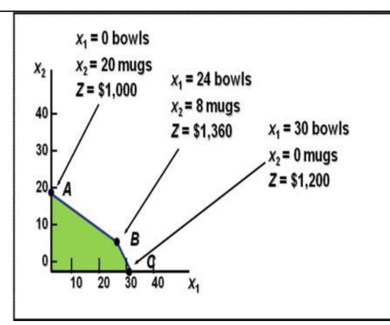
Plot model constraints on a set of coordinates are satisfied simultaneously. Plot objective function to find the point on boundary of this space that maximizes or minimizes value of objective function.



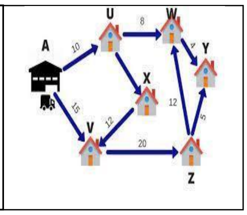
Graphical Solution



Computing Optimal Values



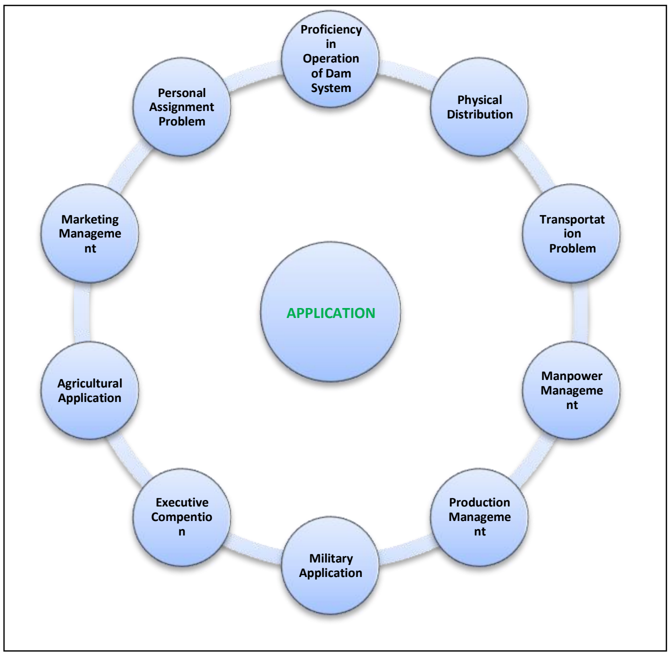
Extreme Corner Points

Let‟s say a FedEx delivery man has 6 packages to deliver in a day. The warehouse is located at point A. The Six delivery destinations are given by U;V;W;X;Y;Z. The numbers on the lines indicate the distance between the cities. . To save on fuel and time the delivery person wants to take the shortest route.	

Application:

Linear Programming Problem applications may include production scheduling; inventory; policies; investment portfolio; allocation of advertising budget; construction of warehouses etc.

Linear Programming has proven to be extremely powerful tool, both in moldering real world problems and as widely applicable mathematical theory. Linear Programming theory falls within convex optimization theory and is also considered to be an important part of business and economics but may also be used to solve certain engineering problem.



Model:

Let, $x_1; x_2; x_3; \ldots\ldots x_n$ = Decision Variables

Z= Objective Function or Linear Function Requirement & Minimization of the Linear Function.

$Z = c_1x_1 + c_2x_2 + c_3x_3 + \ldots.. c_nx_n$------ (1)

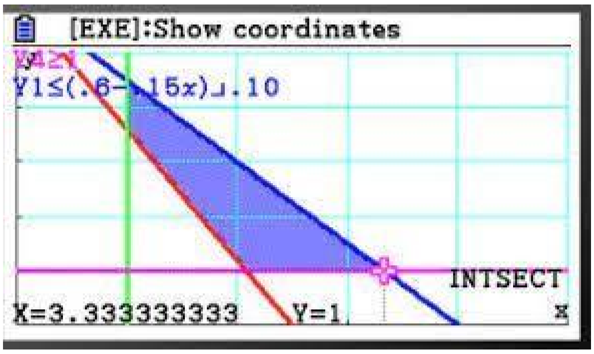
Subject to the following constraints:-

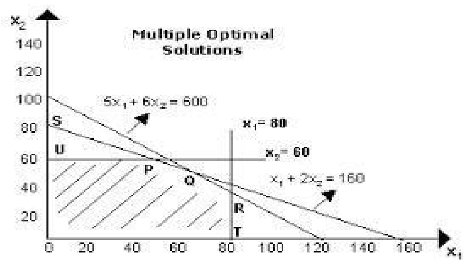
$a_{11}x_1 + a_{12}x_2 + \ldots\ldots + a_{1n}x_n \leq b_1$

$a_{21}x_1 + a_{22}x_2 + \ldots\ldots. + a_{2n}x_n \geq b_2$

$am_1x_1 + am_2x_2 + \ldots.. + a_{mn}x_n \leq b_n$

$a_{11}x_f \geq 0$





Where a_{ij}; b_j and c_j are given constant.

<table>
<tr><td colspan="2">Linear Programming Software: (PROL P. EXE)- Created by WIN WIN MYO

1. To input the data click entry data button 2. To obtain the optimal solution click solve button 3. To entry the new data or to delete the old data click cancel button 4. To solve the problem & solution click the save button 5. To print the problem and solution click the print button</td></tr>
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proLP. exe</td><td></td></tr>
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Conclusion:

Linear Programming is a powerful technique for dealing with resource- allocation problems, cost-benefit-trade-off problems, and fixed requirements problems; as well as other problems having a similar mathematical formulation.

PROBLEM

Maximize $Z= 150x + 100y$

Subject to

$8x + 5y \leq 60$

$4x + 5y \leq 40$

$x,y \geq 0$

Solve the following Linear Programming Problem (LPP) graphically.

SOLUTION

If we convert the given constraints into equation, then we have $8x + 5y = 60$ --- (1) & $4x + 5y = 40$ --- (2)

For equation no (1)

$\frac{8}{60}+\frac{5}{60}=\frac{60}{60}$

$\frac{}{7.5}+\frac{}{12}=1$

(7.5, 0); (0, 12)

For equation no (2)

$\frac{4}{40}+\frac{5}{40}=\frac{40}{40}$

$\frac{}{10}+\frac{}{8}=1$

(10, 0); (0, 8)

For equation no (1)	For equation no (2)
$8x + 5y \leq 60$	$4x + 5y \leq 40$
$\mathbf{0 + 0} \leq 60$	$0 + 0 \leq 40$
$0 \leq 60$ ✓	$0 \leq 40$ ✓

$8x + 5y = 60$

$4x + 5y = 40$

$4x = 20$

Or, $x = 5$

Form equation no (1)

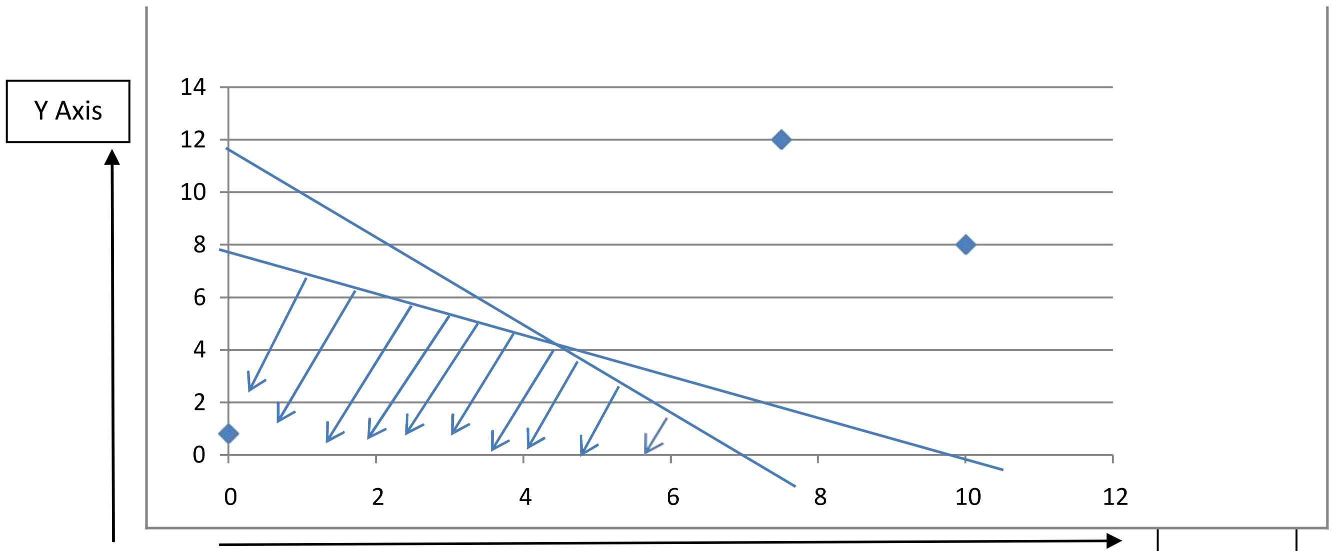
$8x + 5y = 60$

Or, $8 X 5 + 5y = 60$

Or, $40 + 5y = 60$

Or, $5y = 20$

Or, $y = 4$



Points are [A (0, 8); B (7.5, 0); C (5, 4); D (10; 0)]

Z 0 (0,0)= (150 X 0) + (100 X 0) = 0

Z |A (0, 8) = (150 X 0) + (100 X 8) = 800

Z |B (7.5, 0) = (150 X 7.5) + (100 X 0) = 1125

Z |C (5,4) = (150 X 5) +(100 X 4) = 1150

X=5 & Y = 4

The maximum of Z value = 1150

So, Graphical Method is only for Variables.

The Linear Programming Problem (LPP) is a problem that is concern with finding the optimal value of the given linear function. The optimal value can be either maximum value or minimum value.

My first step is to solve each inequality for the more easily graphed equivalent forms:-

$$\left\{\begin{array}{c} \boldsymbol{x}+\boldsymbol{2y} \leq 14 \\ \boldsymbol{3x}-\boldsymbol{y} \geq 0 \\ \boldsymbol{x}-\boldsymbol{y} \leq 2 \end{array}\right\} \Longrightarrow \left\{\begin{array}{c} \boldsymbol{y} \leq -\tfrac{1}{2}\mathrm{x}+7 \\ \boldsymbol{y} \leq 3\mathrm{x} \\ \mathrm{y} \geq \mathrm{x}-2 \end{array}\right\}$$

It is easy to graph the system I take the "EQUAL" version of each inequality (these "EQUALS" versions being the lines forming the edges of the feasibility regions) and solve the system of linear equations formed by each pair of lines.

References:

- Strayer, J.K.(1989)."Linear Programming and Applications"
- Vasek Chv et al. (1983). "Linear Programming