OPTIMIZATION PROBLEMS SOLVED BY DIFFERENT PLATFORMS SAY OPTIMUM TOOL BOX (MATLAB) AND EXCEL SOLVER

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Abstract - *In this paper, the researcher highlights the use of MATLAB and excel solver in solving linear or nonlinear programming problems in an introductory operations research course. This is especially useful for interdisciplinary courses involving optimization problems. This research study explores a broad picture of the various applications of optimization methods used in engineering through different examples concerning areas of like 1. Financial planning 2. Scheduling 3. Transportation 4. Manufacturing.*

Key Words: MATLAB, Optimization, Linear Programming, Non Linear Programming and Quadratic Programming.

1. INTRODUCTION

Optimization problems are real world problems we encounter in many areas such as mathematics, engineering, science, business and economics. Most real-life problems have several conflicting criteria to be considered simultaneously "Optimization is a process of selecting or converging onto a final solution amongst a number of possible options, such that a certain requirement or a set of requirements is best satisfied." i.e., you want a design in which some quantifiable property is minimized or maximized

- The Simplex Algorithm developed by G.B. Danzig ([2], (1963)) is used to solve linear programming problems.
- Work by Kuhn and Tucker in 1951 on the necessary and sufficient conditions for the optimal solution of problems laid the foundation for later research in non-linear programming.

Such problems can be overcome by using limited resources to achieve greater objective for optimum solution in an effective manner. It helps the organization to maximize its profit, minimize cost and time to complete a project or minimizing the total distance travelled or minimizing the total time to complete a project.

This technique can be used to solve problems of higher dimensions. In this paper, the researcher has tried to provide an optimum solution by using tool of MATLAB and Excel solver .

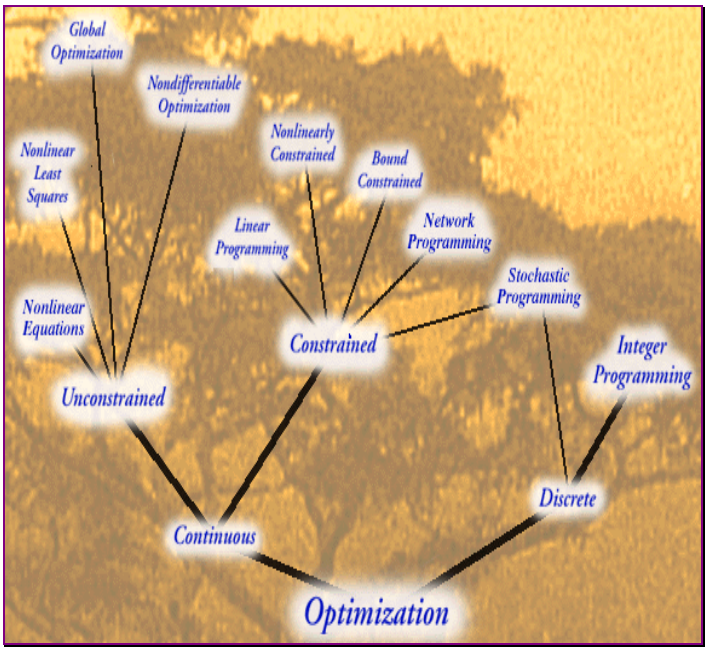
1.1 Mathematical Model & Spread Sheet model:

Optimum tool can be used to run any optimization toolbox solver, and a mathematical model implemented in a spreadsheet is called a spreadsheet model.

There are also certain problems where more than two variables are involved such problems are complex and tedious to calculate but MATLAB and Excel solver has made such problems, fairly a simple task.

The first step is to organize the in command window write optimum tool you will get optimization tool as according to your data put all the things run solver is ready to push the button start we will gets the results and start the procedure of Excel spreadsheet to represent the model. A separate cell is used for decision variables then a formula can be created to represents the objective function and another formula for each constraint left hand side.

1.2. Different kinds of optimization:



2. Main Results:

2.1 Purchasing Problem (Linear Model):

A dealer wishes to purchase a number of fans and sewing machines. He was only Rs 5760 to invest and has space for almost 20 items. A fan costs him Rs. 360 and a sewing machine is Rs. 240. His expectation is that he can sell a fan at profit of Rs. 22 and a sewing machine at a profit of Rs. 18 Assuming that he can sell all the items that he can buy, how should be invest his money in order to maximize.

Creating the Linear Programming model to represent the problem:

Decision variables are the amounts of money should be invested in each item

X_1 = Amount of money to invest in fans

X_2 = Amount of money to invest in sewing machines.

Objective is to maximize the total cost

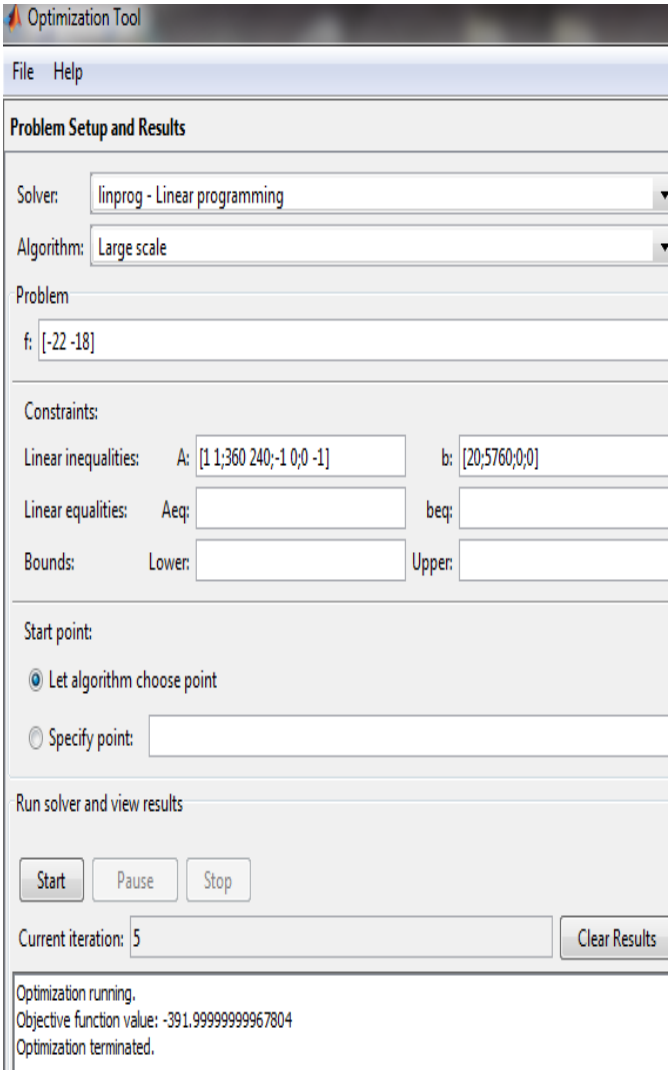
The LPP becomes

$$MaxZ = 22x_1 + 18x_2$$

$$x_1 + x_2 \leq 20$$

$$360x_1 + 240x_2 \leq 5760$$

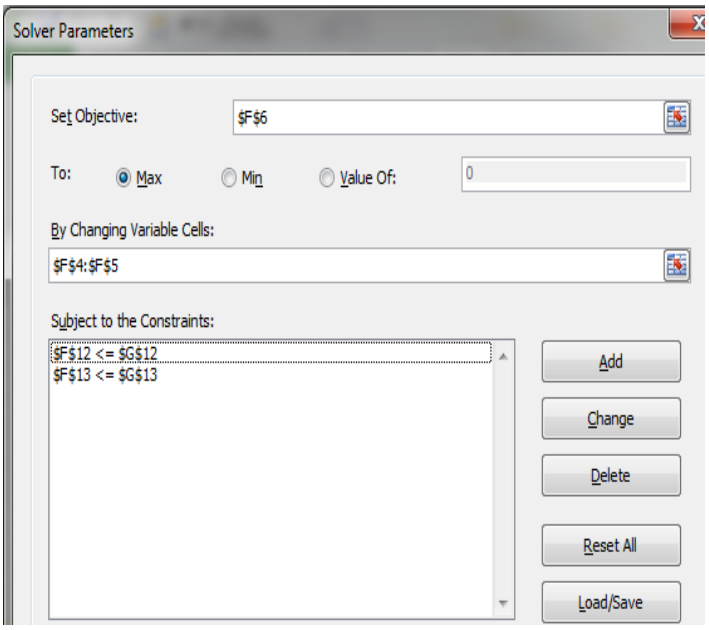
and $x_1, x_2 \geq 0$



2.2. Demonstrate by excel solver:

	A	B	C	D	E	F	G
1	LINEAR PROGRAMMING						
2							
3	Decision variables						
4	x1 represents number of fans					22	
5	x2 represents the number of sewing					18	
6	Objective function					808	
7	profit per fan Rs. 22						
8	profit per sewing machine 18						
9	maximum profit is						
10	Maxz =22x1+18x2						
11	Constraints						
12	He has space 20 items					40	20
13	A fan cost is Rs 360 and a sewing ma					12240	5760
14	He has only Rs 5760						
15							

2.3 Solver Screen:



The maximum value of the objective function z=392 occurs at the extreme point (8, 12).Hence the optimal solution is x_1=8 and x_2=22.

2.4 Problem: Same as above procedure

2.4.1. Maximize z= $3x_1+2x_2$,
Subject to the constraints: $x_1+x_2 \leq 4$, $x_1-x_2 \leq 2$, and $x_1, x_2 \geq 0$

2.4.2. Minimize z= $x_2-3x_3+2x_5$,
Subject to the constraints: $3x_2-x_3+2x_5 \leq 7$, $-2x_2+4x_3 \leq 12$, $-4x_2+3x_3+8x_5 \leq 10$, and $x_2, x_3, x_5 \geq 10$.

3. Nonlinear programming (NLP): NLP is the process of solving an optimization problem defined by a system of equalities and inequalities, collectively termed constraints, over a set of unknown real variables, along with an objective function to be maximized or minimized, where some of the constraints or the objective function are nonlinear.

Determining an optimal solution is often difficult, if not impossible in Quadratic programming: The only difference between the quadratic programming and linear programming, is that the function can be a quadratic form:

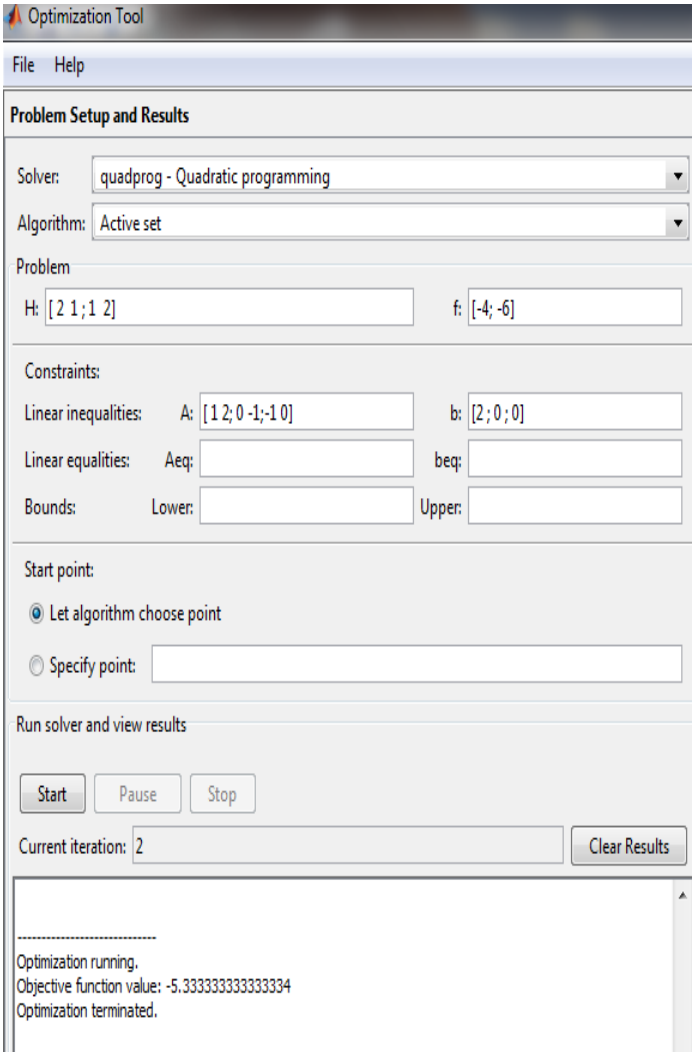
$$\underline{x}^* = \arg\min_{\underline{x}} \underline{x}^T H \underline{x} + \underline{c}^T \underline{x} \quad s.t. \quad \left\{ \mathbf{A}^{(m,n)} \underline{x} = \underline{b}; \mathbf{B}\underline{x} \geq \underline{d} \right\}$$

3.1Problem (Non Linear Quadratic Programming):-

$$max\ z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$

Subject to

$$x_1 + 2x_2 \leq 2 \text{ and } x_1, x_2 \geq 0$$

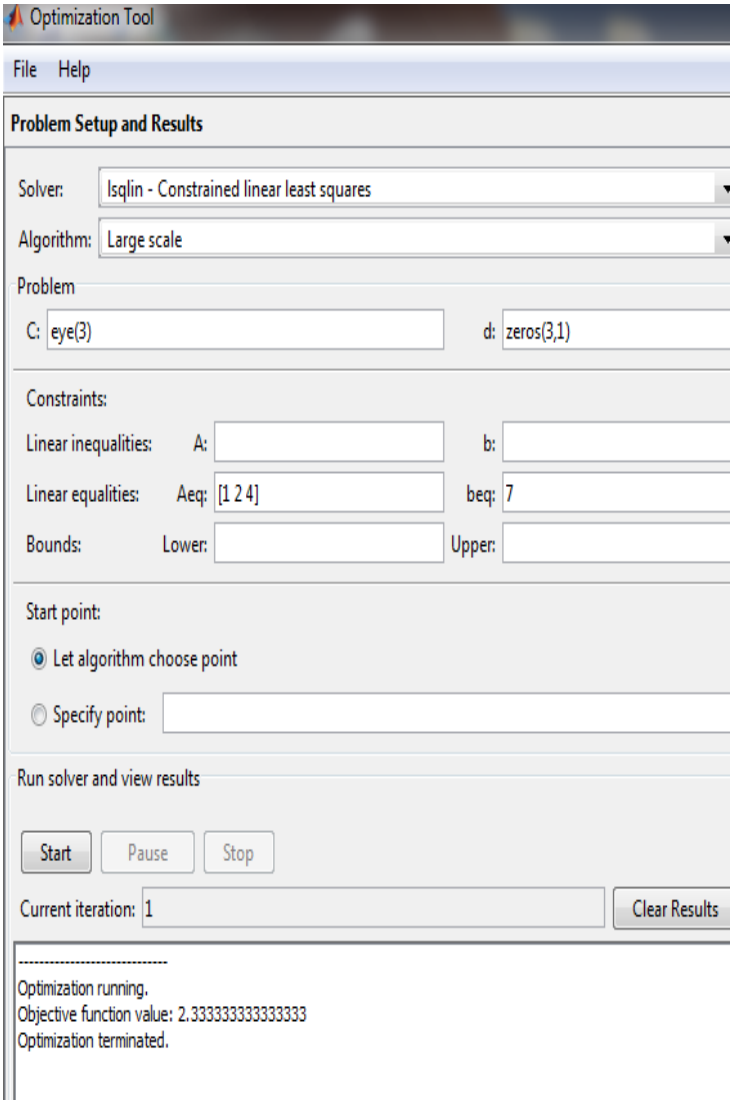


3.2 Problem (Isqlin constrained linear least squares):-

$$\min z = x_1^2 + x_2^2 + x_3^2$$

subject to the constraint

$$x_1 + 2x_2 + 4x_3 = 7.$$



4. CONCLUSIONS

So we can conclude that this method can be use on any Linear Programming , Non Linear Programming, Quadratic Programming, geometric programming, dynamic programming and integer programming,

Optimization problems in many fields can be modeled and solved using MATLAB.

This application will be easily solved by MATLAB. This way is particularly helpful for students who are researchers and still want to take thesis courses. It does not require knowledge of complex mathematical concepts behind the solution algorithms.

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