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Introduction

LPP is a Linear Programming Package, that uses Dual Simplex Algorithm to arrive at an optimal solution, which could either be Maximization or Minimization. It is primarily designed for small and medium size optimization problems -- and can handle problem definitions with a maximum of 100 Decision Variables and 100 Constraints.

With LPP you can :

- Define your optimization problems.
- Modify your existing problem definitions.
- View iterations step by step.
- Generate reports on screen as well as in print.

Procedures

Formulate a Problem Definition
Enter a Problem Definition
Solve a Problem (Optimize)
View Iteration Details
View Solution Details
Print Reports
Save Problem Definition

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Formulate a Problem Definition

Seldom would you have a problem ready with you the way LPP expects it to be, as this package is mathematical in its approach and does not understand plain English. Real life optimization problems are often presented in the form of sentences rather than equations. Knowing how LPP works, the importance of correctly defining (formulating) a problem cannot be over emphasized.

Before proceeding with the Problem Definition, you have to identify the following :

- The Objective of the exercise.
- The Decision Variables contributing to this Objective.
- The Objective Function -- the contribution of each Decision Variable to the Objective.
- The Constraints
- The relation between the Constraints and Decision Variables -- The Matrix of Coefficients.

Enter a Problem Definition

Once you have a correctly formulated problem, to enter the Problem Definition for LPP go through the following steps :

- Enter the Problem Title.
- Enter the Objective of the exercise.
- Enter the Decision Variables.
- Enter the Constraints.
- Enter the Objective Function.
- Enter the Relation between the Constraints and the Decision Variables in the form of Matrix of Coefficients.

Title and Objective Dialog Box

To modify the Title / Objective of the exercise Select :
    File/Title/Objective...

The Title / Objective Dialog consists of :

- Title.
  The Title is the name you give to the exercise.
- Objective.
  The Objective is the objective of the exercise, the objective can either be to Maximize or to Minimize.

Adding Decision Variables and Constraints

- To Add Decision Variables Select :
  Decision Vars/Add New...

- To Add Constraints Select :
  Constraints/Add New...

This will open a Dialog Box to accept the following details.

- Caption : A five letter abbreviation to identify a Decision Variable/Constraint.
- Description : A Description for the Decision Variable/Constraint.

LPP can handle problem definitions with a maximum of 100 Decision Variables and Constraints each.

Entering the Objective Function

In the Problem Definition grid the 1st row is reserved for the Objective Function. It is marked with the Objective of the exercise. After you have entered your Decision Variables you can enter the Objective function in this row.

Solving a Problem Definition

After you have defined / formulated your problem correctly.
To Solve the Problem Select :
Optimize/Solve.

Once you select this option, LPP will create the initial tableau before it starts iterating. After the initial tableau has been created you can either :

- View Iteration Details.
- View Problem Definition.
- Continue the iteration process.
- Cancel solving.

View Iteration Details

Once the problem solving process begins, you have the option of viewing the details of the intermediate steps at various stages. You have the option of viewing the following.

- Matrix of Coefficient, Select :
    Optimize/View Iteration Details/Matrix of Coefficient.
- Basic Variables, Select :
    Optimize/View Iteration Details/Basic Variables.

View Problem Definition

To View the Problem Definition grid Select :
Optimize/View Problem Definition.

Continue Iteration Process

You can Continue the iteration process by either

- Selecting Optimize/Iteration Details/Continue Iteration.
- Or, by pressing F2.

If you have selected *break between iterations* as your preference then this will open a dialog box for you to select the *next iteration break* and the *subsequent steps* to break between iterations.

If you have not selected *break between iterations* as your preference LPP will solve the problem and display the Optimal solution.

Cancel Solving Process

You can Cancel the Solving process by Selecting :
     Optimize/View Iteration Details/Cancel Solution.

This will cancel the Problem Solving process and return to the Problem Definition grid.

View Solution Details

After the problem has been successfully solved, you can view/print the following :

- Optimal Solution.
- Dual Solution.
  Change in the value of Optimal Solution for unit change in Constraint.

Sensitivity Analysis.

- Slack Variables.
  Over/Under utilization of Constraints.
- Constraint Ranging.
  Range of Constraints for which Optimal Solution remains unaltered.
- Cost/Contribution Ranging.
  Cost Range for which Optimal Solution remains unaltered.
- Shadow Prices.
  Changes in the Cost/Contribution of the variables for it to enter the Optimal Solution.

Select :
Optimize / View Solution / *Report Name*

Printing Reports

Report Printing is context sensitive, i.e. selecting the File/Print option will print what is currently displayed on the screen.

To setup your printer Select :
    File/Print Setup...

Saving the Problem Definition

To Save the current Problem Definition Select :

    File/Save

    or

    File/ Save As...

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⊞ Decision Vars
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▤ Options to view this Help File

New Problem Definition

To enter a New Problem Definition Select :
    File/New

When you select this option a fresh Problem Definition grid is ready for you to enter your new Problem Definition.

Open an existing Problem Definition

To Open an existing Problem Definition file Select :
    File/Open...

Specify the Problem Definition file you want to open. This will display the details of the newly opened file in the Problem Definition grid.

Preferences Dialog Box

To set your Preferences Select :
    File/Preferences...

This allows you to set the following :

- Number of Significant Digits to be displayed in the solutions.
  The default is 2, you can have a range from 0 to 6 Significant Digits.

- Whether you want to have breaks between the iterations.

Exit from LPP

To Exit from the LPP session Select : File/Exit.

Modifying Decision Variables and Constraints

You can Modify the Caption and Description of the Decision Variable/Constraint by selecting the appropriate row / column in the Problem Definition grid.

- To Modify Decision Variables Select :
    Decision Vars/Modify...
- To Modify Constraints Select :
    Constraints/Modify...

Deleting Decision Variables and Constraints

You can Delete a Decision Variable/Constraint by selecting the appropriate row/column in the Problem Definition grid.

- To Delete a Decision Variable :
  Select Decision Vars/Delete.

- To Delete a Constraint :
  Select Constraints/Delete.

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View Problem Definition

View Solution Details

Incorrect Problem Definiton

If you encounter any of the following messages :

- Unbounded Solution.
- Infeasible Solution.
- Degenerate Solution.

It is possible that your Problem is not defined / formulated correctly. It could also imply that there is no Optimal solution to the Problem.

Problem Definition Grid

The Problem Definition grid comprises of :

⊞ Objective Function row.
⊞ Decision Variable columns.
⊞ Constraint rows.
⊞ Type column.
⊞ RHS column.

Type Column

The Type Column is used to enter the type of the Constraint, the following Types are valid :

- <= *for Less than or Equal to Constraint.*
- >= *for Greater than or Equal to Constraint.*
- = *for Equal to Constraint.*

RHS Column

This column is used to enter the Right Hand Side for the Constraint -- this sets the Constraint limits.

The maximum limit for <= Constraint
and
The minimum limit for >= Constraint.

Registration Dialog Box

If you have not registered your copy of LPP, to register yourself Select :   Help/Registration.

The dialog box contains the following :

- User Name.
- Serial No.
- Check Code.

It is very important that you fill in the details very carefully.