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Lab Information

1 VILEOPT: Visual LP Optimization

1.1 Introduction

VILEOPT is a program for visual optimization of LP problems under manual control. The main aim is to practice the simplex method by allowing the user to choose entering and leaving variables. Then the program computes the new simplex tableau. The program enables the user to read/enter problem data and introduce various changes to the data (change coefficients, add/remove columns/rows), and save the changed data. The program is implemented in Tcl/Tk by Kaj Holmberg, and run as a tclkit.

To run the program, start a terminal window, and write `/course/TAOP88/dine 2`.

1.2 Model

In VILEOPT constraints must be given in equality form, so all required slack variables, artificial variables etc. must be introduced by the user. The simplex method assumes that the variables are non-negative, which matters for the choice of the leaving variable, and is up to the user to ensure. Thus the following problem is solved:

$$\max/\min\ c^T x \text{ st } Ax = b,\ x \geq 0.$$

1.3 Menu

When VILEOPT is started, a window with the following menus is opened. The first status bar displays the name of the problem (the name of the data file) and the size of the problem. The third status bar contains among others indices for the basic variables.

File "Alt"-f

Here one can read input data for a problem, save data in a current file or in a new one, and temporarily save indices of basic variables. It is also possible to list and erase existing problem files.

Optimization "Alt"-o

Here one can give starting basis, i.e. indices of the basic variables. One can also start an iteration from the current simplex tableau by selecting entering and leaving variables. The selection of variables is performed by clicking on their names. The iteration is done and the new tableau is calculated when one clicks Pivot.

Visualization "Alt"-v

Here one can choose to display the problem and the current tableau.

Changes "Alt"-c

Here one can change problem data. This can be done in table format, for the objective function, right hand side, coefficients of the constraints, or the whole problem at once. (Do not forget to save the changes.) One can also add and remove variables (columns) and constraints (rows). Several data changes can be done simultaneously, e.g. adding a constant to all coefficients of the objective function/right hand side or set all coefficients of the objective function/right hand side to a particular value, or to randomly generated values. (Observe that the program has no "Undo" function.) There is a commentary file associated with each problem, and it can also be changed.

Help "Alt"-h

Here one can get a short help text in a separate window, in Swedish or English. One can also get a list of the available shortcuts.

There is also a couple of buttons below the graphical window which are the shortcuts for the most frequently executed commands, namely Iter: start a simplex iteration, Print: print out the content of the window, and PS: save a postscript figure with the content of the window.

2 Practical hints

VILEOPT is a program for interactive operations with relatively small LP problems. The program helps creating tableaus in the correct form. The user has to give the starting basis and entering and leaving variables. Thus all pivoting methods, which use specific choices of entering and leaving variables, can be implemented, among others maximization or minimization using the primal simplex method, and the dual simplex method.

If phase 1 is required, one should enter the artificial objective function as the objective function, and coefficients for the artificial variables in the constraints. When the optimal solution for phase 1 is found, the artificial variables are removed and the original objective function is entered.

A new constraint requires a new row and often a new slack variable. After adding a constraint the basic solution must be changed, so that the number of basic variables is correct.

One can change coefficients in the program. Observe that the data file is not changed until the problem is saved.

Finally: There is no program without bugs. If one saves the problem often, one simply quits the program, starts it again and reads the problem anew, if strange things should happen.