

Decomposition Exercise 1

CPLEX contains a very simple way to optimize LP or ILP's. GAMS is definitely better when working with problem which are not completely trivial, but as a starting point and for the assignments in this course, CPLEX is fully sufficient. The work is performed in two stages:

- First a file with the LP/ILP problem is formulated in the (cplex).lp format
- The program is read into cplex and optimized. Afterwards, the solution may be studied

The CPLEX lp format

The LP/ILP programs should be specified in the cplex .lp format. The files needs to have the suffix .lp. Below is a simple example of a program.

```
\ A stupid example, this is a comment
```

```
minimize
\maximize
    y1 + 3y2

subject to
c1:   5y1 + 1y2 >= 3
c2:   3y1 + 3y2 >= 5
bounds
    42 <= y1 <= 50
binary
    y2
integer
    y1
end
```

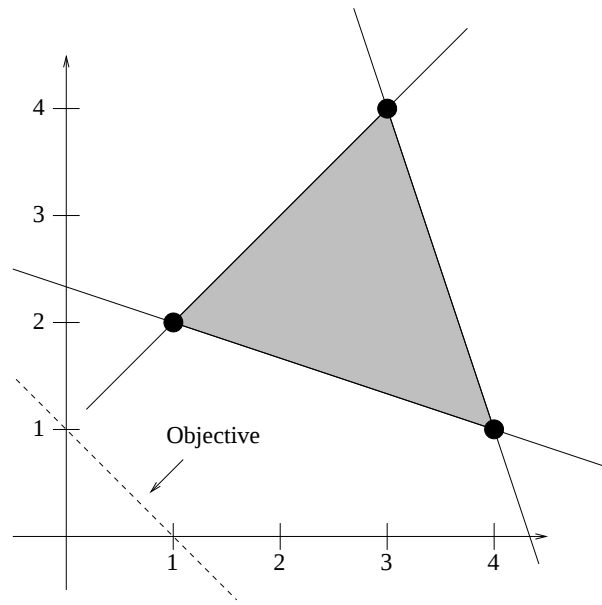
A few comments and warnings:

- If there are no definitions of variable type (i.e. no section “binary” or “integer”), the variables are automatically positive continuous variables.
- No use of multiplications (except between variables and constants i.e. $5y1$), divisions, paranthesis is allowed.

- Only variables on the lefthand side and constants on the righthand side.

To to:

Look at the Figure below:



Now answer the following questions:

1. Formulate the LP program with two variables x and y corresponding to the grey area, with an objective function corresponding to the dashed line which should be maximized
2. Write up the corner points of the polyhedron
3. Formulate the *same* problem, but now based on the three corner points !
4. Solve in both formulations of the same problem using CPLEX ensuring to get the same result !
5. Remove one point from the formulation (point $(3, 4)$), what happens to the objective ?

Optimizing a .lp file

Given a file, start cplex using the

`cplex`

command. Inside the interactive system the following commands are interesting:

- `read test.lp`
: Read a file in the .lp format
- `primopt`
: Use simplex algorithms to optimize an LP problem
- `mipopt`
: Use a mipsolver (Branch & Cut) to optimize ILP problems
- `display solution variables 1-`
: See the resulting optimal values of the variables
- `display solution dual 1-`
: See the dual variables (naturally not for ILP problems)
- `quit`
: Leave the CPLEX interactive solver