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Efficient Algorithms and Datastructures II

Aufgabe 1 (10 Punkte)

Give an example of a linear program for which the feasible region is not bounded, but the optimal objective value is finite. What is the minimum number of constraints needed (in addition to the non-negativity constraints) for such a linear program having d variables?

Aufgabe 2 (10 Punkte)

Let F be the closed region whose boundary is obtained by connecting the following 'vertex' points in the $X - Y$ plane by a straight line segment:
$(0,0),(0,6),(4,9),(3,5),(8,10),(9,6),(11,5),(7,0),(0,0)$
The region F also includes the boundary points. We want to find a point in F which maximizes the linear objective function $x+y$.
Consider the following procedure:
Start from a vertex p (say $(0,0)$) and move to an adjacent vertex q such the value of our linear objective function is greater at q than at p. Call q our new current vertex. Repeat this procedure with the current vertex till you can find an adjacent vertex which does not decrease the value of the linear objective function. When this procedure terminates, are we left with a vertex maximizing the linear objective function? Why? What is the difference between this procedure and the simplex algorithm?

Aufgabe 3 (10 Punkte)

In the simplex algorithm, we are at a current basis B. What does it mean that the co-efficient of a non-basic variable in the objective function is 0?

Aufgabe 4 (10 Punkte)

Consider the following LP:

$$\begin{array}{rrlrrrrrrrr}
\text{maximize } z & = & & & 10x_1 & - & 57x_2 & - & 9x_3 & - & 24x_4 \\
\text{subject to} & & & & & & & & & & \\
x_5 & = & & - & 0.5x_1 & + & 5.5x_2 & + & 2.5x_3 & - & 9x_4 \\
x_6 & = & & - & 0.5x_1 & + & 1.5x_2 & + & 0.5x_3 & - & x_4 \\
x_7 & = & 1 & - & x_1 & & & & & & \\
x_i & \geq & 0 & & & & & & & & \text{for } 1 \leq i \leq 7
\end{array}$$

Solve this LP by using the simplex method. If there are two or more choices for the row (variable leaving the basis) and column (nonbasic variable entering the basis), consider the following 2 approaches:

(a) Choose a column candidate with largest co-efficient in the z equation and choose the row candidate with the smallest index.

(b) Choose the column candidate with smallest index (amongst those having positive coefficients) in the z equation and choose the row candidate with the smallest index. (This is also known as Bland's rule.)

Solve this LP using (a) as well as (b).