EPFL Lausanne

Bachelor semester 4-DO

Discrete Optimization Extra-Credit Homework 1
Solutions (sketch)

Exercise 1:

The bases are $x_1x_2x_4$, $x_1x_3x_4$, $x_1x_4x_5$, $x_2x_3x_4$, $x_2x_4x_5$, $x_3x_4x_5$.

The feasible bases are $x_1x_2x_4$, $x_2x_3x_4$, $x_3x_4x_5$. The corresponding feasible solutions and objective function are:

$x_1 = 150/133$	$x_2 = 26/7$	$x_3 = 0$	$x_4 = 187/133$	$x_5 = 0$	OF = -1122/133
$x_1 = 0$	$x_2 = 194/133$	$x_3 = 150/133$	$x_4 = 187/133$	$x_5 = 0$	OF = -372/133
$x_1 = 0$	$x_2 = 0$	$x_3 = 344/133$	$x_4 = 187/133$	$x_5 = 194/133$	OF = 986/133

Exercise 2:

There are 12 variables, which we denote by F_1, F_2, F_3, F_4, M_1, M_2, M_3, M_4, R_1, R_2, R_3, R_4. For example, M_2 denotes the amount of C2 cargo that we put in the middle compartment.

All variables should be nonnegative. The available amounts give another 4 constraints. The weight limits give another 3 constraints. The volume limits give another 3 constraints. And the plane balancing requirement gives another two equality constraints:

$(F_1+F_2+F_3+F_4)/12 = (M_1+M_2+M_3+M_4)/9 = (R_1+R_2+R_3+R_4)/14$

The optimal solution is roughly: $(F_2\ M_2\ R_2) = (0.7\ 2.7\ 1.6)$, $(F_4\ M_4\ R_4) = (8.2\ 4\ 8.8)$ and all the rest 0.

The profit is roughly CHF 10500. We are taking all of cargo C4 and part of cargo C2. All three compartments are filled to the top of their volume capacity, and to roughly 74% of their weight capacity.