# CS 6505 - Homework 10 - Worked with Qiaomei Li

Caitlin Beecham

## 1

We first establish variable names: $x_1$ = number chairs fresh, $x_2$ = number chairs polished regular, $x_3$ = number chairs polished overtime, $x_4$ = number tables fresh, $x_5$ = number tables polished regular, $x_6$ = number tables polished overtime, $x_7$ = number cabinets fresh, $x_8$ = number cabinets polished regular, $x_9$ = number cabinets polished overtime.
Our LP is to maximize $8x_1 + 14x_2 + 11x_3 + 4x_4 + 12x_5 + 7x_6 + 4x_7 + 13x_8 + 9x_9$ subject to $x_1 + x_2 + x_3 \leq 480$, $x_4 + x_5 + x_6 \leq 400$, $x_7 + x_8 + x_9 \leq 230$, $x_2 + x_5 + x_8 \leq 420$, $x_3 + x_6 + x_9 \leq 250$, and $x_i \geq 0$ for all i. We add slack variables to get, $x_1 + x_2 + x_3 + s_1 = 480$, $x_4 + x_5 + x_6 + s_2 = 400$, $x_7 + x_8 + x_9 + s_3 = 230$, $x_2 + x_5 + x_8 + s_4 = 420$, $x_3 + x_6 + x_9 + s_5 = 250$ and $xi_, sj \geq 0$ for all i,j. Using the simplex method, the optimal solution is $(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9) = (440, 0, 40, 0, 400, 0, 0, 20, 210)$. The dual program is to minimize $480y_1 + 400y_2 + 230y_3 + 420y_4 + 250y_5$ subject to $y_1 \geq 8$, $y_1 + y_4 \geq 14$, $y_1 + y_5 \geq 11$, $y_2 \geq 4$, $y_2 + y_4 \geq 12$, $y_2 + y_5 \geq 7$, $y_3 \geq 4$, $y_3 + y_4 \geq 13$, $y_3 + y_5 \geq 9$, and $y_1 \geq 0$. Since the optimal value for the dual problem is also 10910, we know that our solution was optimal.