FORMULA SHEET: MATH 340

1. Revised Simplex method.

Step 1: Solve $yB = c_B$.

Step 2: Compute $\zeta_i = c_i - y \cdot a_i$ for every non-basic variable and choose an entering column a_i.

Step 3: Solve $Bd = a_i$.

Step 4: Find largest t so that $x_B^* - td \geq 0$. Choose leaving column.

Step 5: Set x_i to be t and any other x_j that stays in the basis to be $x_j^* - td_j$.

The relation to dictionaries:

$$\begin{array}{l} x_B = B^{-1}b - B^{-1}A_N x_N \\ \hline z = c_B B^{-1}b + (c_N - c_B B^{-1}A_N)x_N \end{array}$$

2. Path following algorithm.

Step 1: Set $\gamma = x \cdot t + y \cdot s$ and $\mu = \frac{\gamma}{10(n+m)}$

Step 2: Set $\rho = b - Ax - s$ and $\sigma = c - A^T y + t$.

$$\begin{array}{ll} \text{Solve:} & A\Delta x + \Delta s = \rho \\ & A^T \Delta y - \Delta t = \sigma \\ & T\Delta x + X\Delta t = \mu e - XTe \\ & S\Delta y + Y\Delta s = \mu e - YSe. \end{array}$$

Step 3: Set $q = \max\left\{-\frac{\Delta x_j}{x_j}, -\frac{\Delta s_i}{s_i}, -\frac{\Delta y_i}{y_i}, -\frac{\Delta t_j}{t_j}\right\}$ and $\theta = min\{0.9/q, 1\}$.

Step 4: Put

$$\begin{pmatrix} \tilde{x} \\ \tilde{s} \\ \tilde{y} \\ \tilde{t} \end{pmatrix} = \begin{pmatrix} x \\ s \\ y \\ t \end{pmatrix} + \theta \begin{pmatrix} \Delta x \\ \Delta s \\ \Delta y \\ \Delta t \end{pmatrix}$$