FORMULA SHEET FOR FINAL EXAM

Sensitivity Analysis

Assume that the optimal solution to a linear problem is represented by the final tableau

R	$\widetilde{x}_B$
$\sigma - c^T$	$z(\widetilde{x})$

where $R = B^{-1}A$, $\sigma = c_B^T B^{-1} A$, and $\widetilde{x}_B = B^{-1}b$.

Changes to one coefficient of the objective function:
If x_ℓ is not a basic variable, then $\Delta c_\ell \le \sigma_\ell - c_\ell$.
If x_ℓ is the basic variable of row i, then $-\Delta c_\ell \, R_{ij} \le \sigma_j - c_j$.

Changes to one entry of the resource vector:
$\widetilde{x}_B + \Delta b_\ell \, B^{-1} e_\ell \ge 0$.

Cutting Plane for Mixed Integer Programs

Assume that $x = (x_1, x_2, \dots, x_s) \in \mathbb{R}^s$ satisfies

- $a_1x_1 + a_2x_2 + \cdots + a_sx_s = b$ where $a_j, b \in \mathbb{R}$
- $x_j \ge 0$ for $1 \le j \le s$
- $x_j \in \mathbb{Z}$ for $j \in I$ where $I \subset \{1, 2, \dots, s\}$ is a given subset.

Set $g_j = \text{frac}(a_j)$ and $f = \text{frac}(b)$ and

$$d_j = \begin{cases} g_j & \text{if } j \in I \text{ and } g_j \le f \\ \frac{f}{1-f}(1 - g_j) & \text{if } j \in I \text{ and } g_j > f \\ a_j & \text{if } j \notin I \text{ and } a_j \ge 0 \\ \frac{f}{1-f}(-a_j) & \text{if } j \notin I \text{ and } a_j < 0. \end{cases}$$

Then $d_1x_1 + d_2x_2 + \cdots + d_sx_s \ge f$.