ISyE6669 Deterministic Optimization
Midterm

Question 1

1. F
2. T
3. F
4. T
5. T
6. F

Question 2

1. BCD
2. CD
3. None

Question 3

1. $\bar{c}_4 \geq 0, \bar{c}_5 < 0, \frac{h}{4} > \frac{2}{f_2}, f_2 > 0.$
2. $\bar{c}_4 < 0, f_1 \leq 0, h \geq 0, \bar{c}_5 \geq 0, \bar{c}_6 \geq 0.$ Note that this question does not assume Bland's rules (independent of questions 1), so we need $\bar{c}_5 \geq 0, \bar{c}_6 \geq 0$ to ensure simplex method can detect optimal unboundedness in this iteration.

Question 4

1. The extreme points of P: $\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1/2 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ The extreme points of Q: $\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

2.

$$\begin{aligned}
\min \quad & \begin{bmatrix}2 & 1\end{bmatrix} \sum_{i=1}^{4} \lambda_i \mathbf{x^i} + \begin{bmatrix}-1 & 1\end{bmatrix} \sum_{\mathbf{i=1}}^{\mathbf{3}} \mu_{\mathbf{i}} \mathbf{y^i} \\
\text{s.t.} \quad & \begin{bmatrix}2 & 3\end{bmatrix} \sum_{i=1}^{4} \lambda_i \mathbf{x^i} + \begin{bmatrix}1 & -1\end{bmatrix} \sum_{\mathbf{i=1}}^{\mathbf{3}} \mu_{\mathbf{i}} \mathbf{y^i} \geq \mathbf{5} \\
& \sum_{i=1}^{4} \lambda_i = 1 \\
& \sum_{i=1}^{3} \mu_i = 1 \\
& \lambda_i \geq 0, \mu_i \geq 0.
\end{aligned}$$

Numerical values of all the coefficients are required.

$$\begin{aligned}
\min \quad & \frac{1}{2}\lambda_2 + 2\lambda_3 + 3\lambda_4 - \mu_2 \\
\text{s.t.} \quad & \frac{3}{2}\lambda_2 + 2\lambda_3 + 5\lambda_4 + \mu_2 \geq 5 \\
& \sum_{i=1}^{4} \lambda_i = 1 \\
& \sum_{i=1}^{3} \mu_i = 1 \\
& \lambda_i \geq 0, \mu_i \geq 0.
\end{aligned}$$