MATH 3401 (Ng/Spring 2009)
Handout for Lab on LPs and ILPs
February 11, 2009.

1. Solve the following (LP)s using TORA.

a.

$$\begin{aligned} \text{Maximize } z &= 30x_1 + 20x_2 \\ \text{s.t.} & \\ -x_1 + 2x_2 &\le 10 && (1) \\ -x_1 - x_2 &\ge -8 && (2) \\ 5x_1 + 3x_2 &\le 30 && (3) \\ x_1 &\ge 0 && (4) \\ x_2 &\ge 0 && (5) \end{aligned}$$

b.

$$\begin{aligned} \text{Minimize } z &= 3x_1 - 6x_2 \\ \text{s.t.} & \\ 5x_1 + 7x_2 &\le 35 && (1) \\ -x_1 + 2x_2 &\le 2 && (2) \\ x_1 &\ge 0 && (3) \\ x_2 &\ge 0 && (4) \end{aligned}$$

c.

$$\begin{aligned} \text{Minimize } z &= -2x_1 + 3x_2 \\ \text{s.t.} & \\ -x_1 + 2x_2 &\le 2 && (1) \\ 2x_1 - x_2 &\le 3 && (2) \\ x_2 &\ge 4 && (3) \\ x_1 &\ge 0 && (4) \\ x_2 &\ge 0 && (5) \end{aligned}$$

d.

$$\begin{aligned} \text{Maximize } z &= 3x_1 + 2x_2 \\ \text{s.t.} & \\ 5x_1 + 5x_2 &\ge 25 && (1) \\ -4x_1 + 4x_2 &\le 12 && (2) \\ 2x_1 - 6x_2 &\le 24 && (3) \\ x_1 &\ge 0 && (4) \\ x_2 &\ge 0 && (5) \end{aligned}$$

2. Solve the Bank Scheduling problem in Handout 2 (Prob 5.)

3. Solve the following (ILP) or $(MILP)$ using TORA.

a.

$$\begin{aligned} \text{Maximize } z &= 3x_1 + 2x_2 \\ \text{s.t.} & \\ 2x_1 + 2x_2 &\leq 9 && (1) \\ 3x_1 + 3x_2 &\leq 18 && (2) \\ x_1 &\geq 0 \text{ and integer} && (3) \\ x_2 &\geq 0 \text{ and integer} && (4) \end{aligned}$$

b.

$$\begin{aligned} \text{Maximize } z &= 2x_1 + 3x_2 \\ \text{s.t.} & \\ 5x_1 + 7x_2 &\leq 35 && (1) \\ 4x_1 + 9x_2 &\leq 36 && (2) \\ x_1 &\geq 0 \text{ and integer} && (3) \\ x_2 &\geq 0 \text{ and integer} && (4) \end{aligned}$$

c.

$$\begin{aligned} \text{Maximize } z &= x_1 + x_2 \\ \text{s.t.} & \\ 2x_1 + 5x_2 &\leq 16 && (1) \\ 6x_1 + 5x_2 &\leq 30 && (2) \\ x_1 &\geq 0 \text{ and integer} && (3) \\ x_2 &\geq 0 \text{ and integer} && (4) \end{aligned}$$

d.

$$\begin{aligned} \text{Maximize } z &= 4x_1 + 6x_2 + 2x_3 \\ \text{s.t.} & \\ 4x_1 - 4x_2 &\leq 5 && (1) \\ -x_1 + 6x_2 &\leq 5 && (2) \\ -x_1 + x_2 + x_3 &\leq 5 && (3) \\ x_1 &\geq 0 \text{ and integer} && (4) \\ x_2 &\geq 0 \text{ and integer} && (5) \\ x_3 &\geq 0 \text{ and integer} && (6) \end{aligned}$$

e.

$$\begin{aligned} \text{Maximize } z &= 3x_1 + 5x_2 + 4x_3 - 2x_4 \\ \text{s.t.} & \\ 3x_1 + 4x_2 + 2x_3 + x_4 &\leq 60 && (1) \\ 4x_1 + 6x_2 + 2x_3 &\leq 40 && (2) \\ 12x_1 + 3x_2 + x_3 + 3x_4 &\leq 53 && (3) \\ x_1,\, x_2 &\geq 0 && (4) \\ x_3 & \quad \text{unrestricted and integer} && (5) \\ 1 \leq x_4 &\leq 5 \text{ and integer} && (6) \end{aligned}$$