

Note: In this problem set, expressions in green cells match corresponding expressions in the text answers.

```
Clear["Global`*"]
```

1. Maximize  $z = f_1[x] = 7x_1 + 14x_2$  subject to  $0 \leq x_1 \leq 6$ ,  
 $0 \leq x_2 \leq 3$ ,  $7x_1 + 14x_2 \leq 84$

```
Maximize[{7 x + 14 y, 7 x + 14 y ≤ 84, 0 ≤ x ≤ 6, 0 ≤ y ≤ 3}, {x, y}]
```

```
{84, {x → 6, y → 3}}
```

3. Maximize the daily output in producing  $x_1$  steel sheets by process  $P_A$  and  $x_2$  steel sheets by process  $P_B$  subject to the constraints of labor hours, machine hours, and raw material supply:

$3x_1 + 2x_2 \leq 180$ ,  $4x_1 + 6x_2 \leq 200$ ,  $5x_1 + 3x_2 \leq 160$

```
Maximize[{x + y, 3 x + 2 y ≤ 180, 4 x + 6 y ≤ 200, 5 x + 3 y ≤ 160}, {x, y}]
```

```
{40, {x → 20, y → 20}}
```

4. Maximize

$z = 300x_1 + 500x_2$  subject to  $2x_1 + 8x_2 \leq 60$ ,  $2x_1 + x_2 \leq 30$ ,  $4x_1 + 4x_2 \leq 60$

5. Do problem 4 with the last two constraints interchanged. Comment on the resulting simplification.

The comment in problem 5 goes over my head. I assume the physical layout and maneuverability of the simplex matrix changes if the order of the constraint equations is swapped.

```
Maximize[{300 x + 500 y, 2 x + 8 y ≤ 60, 2 x + y ≤ 30, 4 x + 4 y ≤ 60}, {x, y}]
```

```
{5500, {x → 10, y → 5}}
```

But to the Maximize function it matters not at all.

```
Maximize[{300 x + 500 y, 2 x + 8 y ≤ 60, 4 x + 4 y ≤ 60, 2 x + y ≤ 30}, {x, y}]
```

```
{5500, {x → 10, y → 5}}
```

7. Maximize  $f =$

$5x_1 + 8x_2 + 4x_3$  subject to  $x_j \geq 0$  ( $j = 1, \dots, 5$ ) and  $x_1 + x_3 + x_5 = 1$ ,  
 $x_2 + x_3 + x_4 = 1$

```
Clear["Global`*"]
```

```
Maximize[{5 x + 8 y + 4 z, x ≥ 0, y ≥ 0, z ≥ 0,
  w ≥ 0, u ≥ 0, x + z + u == 1, y + z + w == 1}, {x, y, z, w, u}]
```

```
{13, {x → 1, y → 1, z → 0, w → 0, u → 0}}
```

9. Maximize  $f = 2x_1 + 3x_2 + 2x_3$ ,  $x_1 \geq 0$ ,  $x_2 \geq 0$ ,  
 $x_3 \geq 0$ ,  $x_1 + 2x_2 - 4x_3 \leq 2$ ,  $x_1 + 2x_2 + 2x_3 \leq 5$

```
Maximize[{2 x + 3 y + 2 z, x ≥ 0, y ≥ 0,
  z ≥ 0, x + 2 y - 4 z ≤ 2, x + 2 y + 2 z ≤ 5}, {x, y, z}]
```

```
{9, {x → 4, y → 0, z →  $\frac{1}{2}$ }}
```