

## V2.1. Linear programming. List of problems.

V2.1.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = -3x_1 + 2x_2 \rightarrow \min,$$
$$\begin{cases} 4x_1 + 2x_2 \geq 1, \\ 3x_1 + 4x_2 \leq 12, \\ x_1 + x_2 = 3, \\ x_1 \geq 0, x_2 \geq 0. \end{cases}$$

V2.1.2. Solve the following LP problem.

$$z = 3x_1 + x_2 + x_4 - x_5 \rightarrow \min,$$
$$\begin{cases} 2x_1 - x_2 + x_4 - x_5 = 9, \\ 4x_1 - x_2 - x_3 - x_5 = 4, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

V2.1.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = x_1 - 2x_2 + 2x_3 - x_4 \rightarrow \max,$$
$$\begin{cases} 2x_1 - x_2 + 2x_3 + x_4 \leq 10, \\ x_1 + x_2 - x_3 + x_4 = 10, \\ x_j \geq 0, \quad j = \overline{1,4}. \end{cases}$$

## V2.2. Linear programming. List of problems.

V2.2.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= x_1 - x_2 - 3x_3 \rightarrow \min, \\ \begin{cases} 2x_1 - x_2 + x_3 &\leq 1, \\ 4x_1 - 2x_2 + x_3 &\geq -5, \\ 3x_1 + x_3 &\leq 5, \end{cases} \\ x_1 &\geq 0, \quad x_2 \geq 0, \quad x_3 \geq 0. \end{aligned}$$

V2.2.2. Solve the following LP problem.

$$\begin{aligned} z &= 4x_1 - x_2 + 2x_3 + x_5 \rightarrow \min, \\ \begin{cases} 3x_1 - x_2 + 2x_3 + x_4 + x_5 &= 12, \\ x_1 - 5x_2 - x_4 + x_5 &= -4, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1, 5}. \end{aligned}$$

V2.2.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 + x_2 - x_3 - x_4 \rightarrow \max, \\ \begin{cases} x_1 - x_2 + x_3 - 2x_4 &\leq 12, \\ x_1 + 3x_2 - x_3 + 2x_4 &= 12, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1, 4}. \end{aligned}$$

### V2.3. Linear programming. List of problems.

V2.3.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 2x_1 + x_2 - x_3 \rightarrow \max,$$
$$\begin{cases} x_1 - 2x_2 + x_3 \geq 5, \\ x_1 + x_2 - 3x_3 \leq 11, \\ x_1 + 3x_2 + 2x_3 = 10, \\ x_j \geq 0, \quad j = \overline{1,3}. \end{cases}$$

V2.3.2. Solve the following LP problem.

$$z = 3x_1 + x_2 + x_4 - x_5 \rightarrow \min,$$
$$\begin{cases} 2x_1 - x_2 + x_4 - x_5 = 6, \\ 4x_1 - x_2 - x_3 - x_5 = 4, \\ x_1 - x_2 - x_3 - x_5 \leq 1, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

V2.3.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = x_1 - x_2 + 2x_4 + 2x_5 \rightarrow \max,$$
$$\begin{cases} x_1 - 2x_3 + 2x_4 - 3x_5 \leq 4, \\ 2x_1 + x_2 + 4x_3 + x_5 \leq 4, \\ -x_1 + 2x_2 + 3x_4 = 6, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

## V2.4. Linear programming. List of problems.

V2.4.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 - x_2 + 3x_4 + 2x_5 \rightarrow \max, \\ \begin{cases} x_1 - 2x_3 + 2x_4 - 3x_5 &\leq 4, \\ 2x_1 + x_2 + 4x_3 + x_5 &= 6, \\ -x_1 + 2x_2 + 3x_4 &= 6, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$

V2.4.2. Solve the following LP problem.

$$\begin{aligned} z &= x_1 - 2x_2 + x_3 - x_5 \rightarrow \max, \\ \begin{cases} x_1 - 3x_2 + x_3 + 2x_5 &= 8, \\ 4x_2 + 3x_4 - x_5 &= 8, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$

V2.4.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= x_1 - 2x_2 + 3x_3 - x_4 \rightarrow \max, \\ \begin{cases} 2x_1 + x_2 + 2x_3 + 3x_4 &\leq 6, \\ x_1 + 2x_2 - x_3 + x_4 &\leq 3, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,4}. \end{aligned}$$

## V2.5. Linear programming. List of problems.

V2.5.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 - x_2 \rightarrow \min, \\ \begin{cases} -4x_1 + 3x_2 &\leq 12, \\ x_1 - 4x_2 &\leq 8, \\ 6x_1 + 5x_2 &\geq 10, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,2}. \end{aligned}$$

V2.5.2. Solve the following LP problem.

$$\begin{aligned} z &= x_1 - 2x_2 - x_3 + x_4 \rightarrow \max, \\ \begin{cases} x_1 - 3x_2 + x_3 &+ 2x_5 = 8, \\ 4x_2 &+ 3x_4 - x_5 = 8, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$

V2.5.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 - x_2 + 2x_3 \rightarrow \max, \\ \begin{cases} x_1 - 2x_2 + x_3 &\geq 5, \\ x_1 + x_2 - 3x_3 &\leq 11, \\ x_1 + 3x_2 + 2x_3 &= 10, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,3}. \end{aligned}$$

## V2.6. Linear programming. List of problems.

V2.6.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = -3x_1 + x_2 \rightarrow \max,$$
$$\begin{cases} 2x_1 + 3x_2 \leq 9, \\ -x_1 + 2x_2 \geq 4, \\ 2x_1 - x_2 \leq 2, \end{cases}$$
$$x_j \geq 0, \quad j = \overline{1,2}.$$

V2.6.2. Solve the following LP problem.

$$z = 2x_1 + x_2 - 2x_3 - 2x_4 + x_5 \rightarrow \max,$$
$$\begin{cases} -x_1 + x_2 + 2x_3 & = & 4, \\ x_1 - x_2 + & x_4 & = & 3, \\ x_1 + x_2 + & & x_5 & = & 2, \end{cases}$$
$$x_j \geq 0, \quad j = \overline{1,5}.$$

V2.6.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 2x_1 + x_2 + x_3 - 2x_4 \rightarrow \max,$$
$$\begin{cases} x_1 - x_2 + 2x_3 - 2x_4 \leq 10, \\ x_1 + 2x_2 - x_3 + 2x_4 = 7, \end{cases}$$
$$x_j \geq 0, \quad j = \overline{1,4}.$$

## V2.7. Linear programming. List of problems.

V2.7.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 4x_1 + 2x_2 \rightarrow \max,$$
$$\begin{cases} 2x_1 + 3x_2 \leq 18, \\ -x_1 + 3x_2 \leq 9, \\ 2x_1 - x_2 \leq 10, \\ x_j \geq 0, \quad j = \overline{1,2}. \end{cases}$$

V2.7.2. Solve the following LP problem.

$$z = 2x_1 - x_2 + 3x_3 - 2x_4 + x_5 \rightarrow \max,$$
$$\begin{cases} -x_1 + x_2 + x_3 & = 1, \\ x_1 - x_2 + x_4 & = 1, \\ x_1 + x_2 + x_5 & = 2, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

V2.7.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 2x_1 + x_2 + x_4 \rightarrow \min,$$
$$\begin{cases} 2x_1 - x_2 + x_4 - x_5 \leq 10, \\ 4x_1 - x_2 - x_3 - x_5 = 8, \\ x_1 - x_2 - x_3 - x_5 \leq 4, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

## V2.8. Linear programming. List of problems.

V2.8.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= x_1 + 2x_2 - x_3 \rightarrow \min, \\ \begin{cases} 2x_1 + x_2 - x_3 &\leq 8, \\ 4x_1 - 2x_2 + x_3 &\geq -1, \\ 2x_1 + x_3 &\leq 5, \end{cases} \\ x_1 &\geq 0, x_2 \geq 0, x_3 \geq 0. \end{aligned}$$

V2.8.2. Solve the following LP problem.

$$\begin{aligned} z &= x_1 + x_2 + x_3 + x_5 \rightarrow \min, \\ \begin{cases} x_1 - x_4 - 2x_6 &= 5, \\ x_2 + 2x_4 - 3x_5 + x_6 &= 3, \\ x_3 + 2x_4 - 5x_5 + 6x_6 &= 8, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,6}. \end{aligned}$$

V2.8.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 3x_1 - x_2 + x_4 + 2x_5 \rightarrow \min, \\ \begin{cases} 2x_1 - x_2 + x_4 + x_5 &= 9, \\ 4x_1 - x_2 - x_3 - 2x_5 &\leq 5, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$



## V2.9. Linear programming. List of problems.

V2.9.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 + x_2 \rightarrow \min, \\ \begin{cases} -4x_1 + 3x_2 &\leq 12, \\ x_1 - 4x_2 &\leq 4, \\ 6x_1 + 5x_2 &\geq 20, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,2}. \end{aligned}$$

V2.9.2. Solve the following LP problem.

$$\begin{aligned} z &= x_1 - 2x_2 + 3x_3 \rightarrow \min, \\ \begin{cases} -2x_1 + x_2 + 3x_3 = 2, \\ 2x_1 + 3x_2 + 4x_3 = 6, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,3}. \end{aligned}$$

V2.9.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 + x_2 + 3x_3 + 5x_4 \rightarrow \min, \\ \begin{cases} 2x_1 + 3x_2 + x_3 + 2x_4 &\leq 30, \\ 4x_1 + 2x_2 + x_3 + 2x_4 &\leq 40, \\ x_1 + 2x_2 + 3x_3 + x_4 &\leq 25, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,4}. \end{aligned}$$

## V2.10. Linear programming. List of problems.

V2.10.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = -2x_1 - 5x_2 \rightarrow \min,$$

$$\begin{cases} 4x_1 + 2x_2 \geq 1, \\ 3x_1 + 4x_2 \leq 12, \\ x_1 + x_2 = 3, \\ x_1 \geq 0, x_2 \geq 0. \end{cases}$$

V2.10.2. Solve the following LP problem.

$$z = 4x_1 - x_2 + 2x_3 + 3x_5 \rightarrow \min,$$

$$\begin{cases} 3x_1 - x_2 + 2x_3 + x_4 + x_5 = 12, \\ x_1 - 5x_2 - x_4 + x_5 = -4, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

V2.10.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = x_1 - x_2 + 2x_4 + 3x_5 \rightarrow \max,$$

$$\begin{cases} x_1 - 2x_3 + 2x_4 - 3x_5 \leq 4, \\ 2x_1 + x_2 + 4x_3 + x_5 \leq 4, \\ -x_1 + 2x_2 + 3x_4 = 6, \\ x_j \geq 0, \quad j = \overline{1,5}. \end{cases}$$

### V2.11. Linear programming. List of problems.

V2.11.1. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 3x_1 - x_2 + 3x_4 + 2x_5 \rightarrow \max, \\ \begin{cases} x_1 - 2x_3 + 2x_4 - 3x_5 &\leq 4, \\ 2x_1 + x_2 + 4x_3 + x_5 &= 6, \\ -x_1 + 2x_2 + 3x_4 &= 6, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$

V2.11.2. Solve the following LP problem.

$$\begin{aligned} z &= x_1 - 2x_2 - x_3 + x_4 \rightarrow \max, \\ \begin{cases} x_1 - 3x_2 + x_3 + 2x_5 &= 10, \\ 4x_2 + 3x_4 - x_5 &= 8, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,5}. \end{aligned}$$

V2.11.3. Reduce the following LP problem to a canonical form and solve the problem.

$$\begin{aligned} z &= 2x_1 + x_2 + x_3 - 2x_4 \rightarrow \max, \\ \begin{cases} x_1 - x_2 + 2x_3 - 2x_4 &\leq 13, \\ x_1 + 2x_2 - x_3 + 2x_4 &= 7, \end{cases} \\ x_j &\geq 0, \quad j = \overline{1,4}. \end{aligned}$$

## V2.12. Linear programming. List of problems.

V2.12.1. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 4x_1 + 2x_2 \rightarrow \max,$$
$$\begin{cases} 2x_1 + 3x_2 \leq 15, \\ -x_1 + 3x_2 \leq 9, \\ 2x_1 - x_2 \leq 10, \\ x_j \geq 0, \quad j = \overline{1,2}. \end{cases}$$

V2.12.2. Solve the following LP problem.

$$z = x_1 + x_2 + x_3 + x_5 \rightarrow \min,$$
$$\begin{cases} x_1 & & - x_4 & & - 2x_6 & = & 5, \\ & x_2 & & + 2x_4 & - 3x_5 & + x_6 & = 6, \\ & & x_3 & + 2x_4 & - 5x_5 & + 6x_6 & = 8, \\ x_j \geq 0, \quad j = \overline{1,6}. \end{cases}$$

V2.12.3. Reduce the following LP problem to a canonical form and solve the problem.

$$z = 2x_1 + x_2 - x_3 - x_4 \rightarrow \max,$$
$$\begin{cases} x_1 - x_2 + x_3 - 2x_4 \leq 14, \\ x_1 + 3x_2 - x_3 + 2x_4 = 12, \\ x_j \geq 0, \quad j = \overline{1,4}. \end{cases}$$