1. $x_1$ – daily production of model A, $x_2$ – daily production of model B and $x_3$ – daily production of model C. The LP problem is

$$\text{max} \quad z = 4x_1 + 2x_2 + 3x_3$$

subject to

$$7x_1 + 3x_2 + 6x_3 \leq 20$$
$$4x_1 + 4x_2 + 5x_3 \leq 120$$
$$x_1, x_2, x_3 \geq 0.$$ 

2. $x_1$ – number of advertising units in daytime TV; $x_2$ – number of advertising units in prime time TV; $x_3$ – number of advertising units in radio; $x_4$ – number of advertising units in newspapers. The LP problem:

$$\text{max} \quad z = 400,000x_1 + 900,000x_2 + 500,000x_3 + 200,000x_4$$

subject to

$$40,000x_1 + 75,000x_2 + 30,000x_3 + 15,000x_4 \leq 800,000$$
$$300,000x_1 + 400,000x_2 + 200,000x_3 + 100,000x_4 \geq 200,000$$
$$40,000x_1 + 75,000x_2 \geq 500,000$$
$$x_1 \geq 3$$
$$x_2 \geq 2$$
$$x_3 \geq 5$$
$$x_4 \leq 10$$
$$x_4 \geq 5$$
$$x_4 \leq 10.$$ 

3. $x_i$ – number of Grade $i$ inspectors, $i = 1, 2$. The LP problem:

$$\text{min} \quad z = 40x_1 + 36x_2$$

subject to

$$x_1 \leq 8,$$
$$x_2 \leq 10,$$
$$200x_1 + 120x_2 \geq 1800,$$
$$x_1, x_2 \geq 0.$$ 

4. $x_i$ – number of part $i$ produced per day, $i = 1, 2$. The LP problem:

$$\text{max} \quad z = y$$

subject to

$$4x_1 + 3x_2 \leq 480,$$
$$3x_1 + 5x_2 \leq 480,$$
$$x_1 - 2x_2 \leq 30,$$
$$-x_1 + 2x_2 \leq 30,$$
$$x_1 \geq y,$$
$$x_2 \geq y,$$
$$x_1, x_2, y \geq 0.$$ 

In this formulation, $y = \min\{x_1, x_2\}$. 

5. $b_1$ – number of bulbs produced inside;
$g_1$ – number of globes produced inside;
$f_1$ – number of filaments produced inside;
$b_2$ – number of bulbs produced outside;
$g_2$ – number of globes produced outside;
$f_2$ – number of filaments produced outside.

The LP problem:
\[
\begin{align*}
\text{min} & \quad z = 0.05b_1 + 0.06b_2 + 0.03g_1 + 0.04g_2 + 0.10f_1 + 0.14f_2 \\
\text{subject to} & \quad 0.04b_1 + 0.07g_1 + 0.06f_1 \leq 1600, \\
& \quad 0.05b_1 + 0.03g_1 + 0.03f_1 \leq 1400, \\
& \quad 0.06b_1 + 0.05g_1 + 0.06f_1 \leq 1500, \\
& \quad b_1 + b_2 \geq 12000, \\
& \quad g_1 + g_2 \geq 12000, \\
& \quad f_1 + f_2 \geq 12000, \\
& \quad b_i, g_i, f_i \geq 0 \quad i = 1, 2.
\end{align*}
\]

6. \( M \) – number of Modern type built
\( D \) – number of Deluxe type built
\( S \) – number of Supreme type built

LP Problem (in 1,000$):
\[
\begin{align*}
\text{max} & \quad z = 20.5M + 44D + 55S \\
\text{subject to} & \quad 180M + 240D + 300S \leq 48000 \\
& \quad 100M + 150D + 175S \leq 34000 \\
& \quad M + D + S = 200 \\
& \quad S \geq 40 \\
& \quad M \geq 30 \\
& \quad M, D, S \geq 0.
\end{align*}
\]

7. Let \( x_1 = \max\{x, 0\} \)
   \( x_2 = \max\{-x, 0\} \)
   \( x_3 = \max\{y, 0\} \)
   \( x_4 = \max\{-y, 0\} \)
   \( x_5 = \max\{z, 0\} \)
   \( x_6 = \max\{-z, 0\} \)

Then, the LP problem is
\[
\begin{align*}
\text{min} & \quad z = \sum_{i=1}^{6} x_i \\
\text{subject to} & \quad x_1 - x_2 + x_3 - x_4 + x_5 - x_6 = 1 \\
& \quad 2x_1 - 2x_2 + x_5 - x_6 + x_8 = 3 \\
& \quad x_i \geq 0, \quad i = 1, 2, ..., 6
\end{align*}
\]

where \(x_7\) and \(x_8\) are slack variables.

8. Note that \(x_2\) is a free variable, so solving the first constraint equation gives \(x_2 = -2 + x_1 + x_3/2\).

The standard form is
\[
\begin{align*}
\text{min} & \quad -(5x_1 + 3x_3) \\
\text{subject to} & \quad x_1 - x_3 = 1 \\
& \quad x_1, x_3 \geq 0.
\end{align*}
\]

Note that in the new cost we have got rid of the constant 8.

9. (i) \( \mathbf{x} = (4, -3, 0)^T \); (ii) \( \mathbf{x} = (1.75, 0, -0.75)^T \); (iii) \( \mathbf{x} = (0, 7/3, -4/3)^T \).