Simplex Method-Maximizing

(1) Maximize $p = 20x_1 + 24x_2$ subject to the constraints

$$\begin{aligned} x_1 + 2x_2 &\leq 20 \\ 2x_1 + x_2 &\leq 16 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Ans: $p = 272$ at $x_1 = 4, x_2 = 8$.

(2) Maximize $p = 4x_1 - 6x_2 + 5x_3$ subject to the constraints

$$\begin{aligned} -x_1 + x_2 &\leq 1 \\ x_2 + 2x_3 &\leq 4 \\ 2x_1 + x_3 &\leq 6 \\ 2x_2 + x_3 &\leq 1 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

Ans: $p = 15$ at $x_1 = 5/2, x_2 = 0, x_3 = 1$.

(3) Maximize $p = 2x_1 - x_2 + x_3$ subject to the constraints

$$\begin{aligned} -x_1 + 5x_2 - 2x_3 &\leq 10 \\ 2x_1 + x_2 - x_3 &\leq 5 \\ x_1 - x_2 + 2x_3 &\leq 4 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

Ans: $p = 31/5$ at $x_1 = 14/5, x_2 = 0, x_3 = 3/5$.

(4) Maximize $p = 2x_1 + x_2 + 3x_3$ subject to the constraints

$$\begin{aligned} 2x_1 - x_2 + x_3 &\leq 6 \\ x_1 + 3x_3 &\leq 9 \\ 2x_1 + 2x_2 + x_3 &\leq 12 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

Ans: $p = 14$ at $x_1 = 3, x_2 = 2, x_3 = 2$.

(5) Maximize $p = 8x_1 + 9x_2 + 4x_3$ subject to the constraints

$$\begin{aligned} x_1 + x_2 + 2x_3 &\leq 2 \\ 2x_1 + 3x_2 + 4x_3 &\leq 3 \\ 7x_1 + 6x_2 + 2x_3 &\leq 8 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

Ans: $p = 31/3$ at $x_1 = 2/3, x_2 = 5/9, x_3 = 0$.

(6) Maximize $p = 2x_1 + x_2 + 6x_3 + x_4$ subject to the constraints

$$\begin{aligned} x_1 + 3x_2 + x_3 + x_4 &\leq 4 \\ x_1 + x_3 + 2x_4 &\leq 5 \\ x_2 + x_3 &\leq 2 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Ans: $p = 16$ at $x_1 = 2, x_2 = 0, x_3 = 2, x_4 = 0$.

(7) Maximize $p = x_1 + 2x_2 + 3x_3 + x_4$ subject to the constraints

$$\begin{aligned} 2x_1 - x_3 &\leq 4 \\ x_2 + x_3 + x_4 &\leq 8 \\ -x_1 + 2x_2 - x_4 &\leq 2 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Ans: $p = 30$ at $x_1 = 6, x_2 = 0, x_3 = 8, x_4 = 0$.

(8) Maximize $p = x_1 + 2x_2 + x_3 + 5x_4$ subject to the constraints

$$\begin{aligned} x_1 + x_3 + x_4 &\leq 50 \\ 3x_1 + x_2 + 2x_3 + x_4 &\leq 100 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Ans: $p = 350$ at $x_1 = 0, x_2 = 50, x_3 = 0, x_4 = 50$.

(9) Maximize $p = x_1 + 2x_2 + 4x_3 + 5x_4$ subject to the constraints

$$\begin{aligned} x_1 + x_2 + x_4 &\leq 44 \\ 2x_1 + x_2 + 2x_3 + 5x_4 &\leq 200 \\ x_1 + x_3 &\leq 50 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Ans: $p = 330$ at $x_1 = 0, x_2 = 30, x_3 = 50, x_4 = 14$.

(10) Maximize $p = x_1 + 2x_2 + 3x_3 + x_4$ subject to the constraints

$$\begin{aligned} 2x_1 + x_2 + x_3 &\leq 18 \\ 3x_1 + x_2 + 2x_3 + 3x_4 &\leq 36 \\ x_1 + x_3 &\leq 12 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

Ans: $p = 50$ at $x_1 = 0, x_2 = 6, x_3 = 12, x_4 = 2$.