

The Simplex Method on the TI-83/84

Example:

1) Introduce slack variables:

$$\begin{aligned} &\text{Maximize} \\ &P = 50x_1 + 80x_2 \\ &\text{Subject to} \\ &x_1 + 2x_2 \leq 32 \\ &3x_1 + 4x_2 \leq 84 \\ &x_1, x_2 \geq 0 \end{aligned}$$

$$\begin{aligned} x_1 + 2x_2 + s_1 &= 32 \\ 3x_1 + 4x_2 + s_2 &= 84 \\ x_1, x_2, s_1, s_2 &\geq 0 \end{aligned}$$

2) Set up the *Initial System*

$$\begin{aligned} x_1 + 2x_2 + s_1 &= 32 \\ 3x_1 + 4x_2 + s_2 &= 84 \\ -50x_1 - 80x_2 + P &= 0 \\ x_1, x_2, s_1, s_2 &\geq 0 \end{aligned}$$

3) Set up *Initial Simplex Tableau*

$$\begin{array}{c} x_1 \quad x_2 \quad s_1 \quad s_2 \quad P \\ s_1 \left[\begin{array}{cccccc} 1 & 2 & 1 & 0 & 0 & 32 \end{array} \right] \\ s_2 \left[\begin{array}{cccccc} 3 & 4 & 0 & 1 & 0 & 84 \end{array} \right] \\ P \left[\begin{array}{cccccc} -50 & -80 & 0 & 0 & 1 & 0 \end{array} \right] \end{array}$$

4) Put the matrix as matrix [A] into the calculator and display [A].

5) Pick the Pivot Element

$$\begin{array}{c} x_1 \quad x_2 \quad s_1 \quad s_2 \quad P \\ s_1 \left[\begin{array}{cccccc} 1 & \boxed{2} & 1 & 0 & 0 & 32 \end{array} \right] \begin{array}{l} \cdot \frac{32}{2} = 16 \leftarrow \text{pivot row} \\ \cdot \frac{84}{4} = 21 \end{array} \\ s_2 \left[\begin{array}{cccccc} 3 & 4 & 0 & 1 & 0 & 84 \end{array} \right] \\ P \left[\begin{array}{cccccc} -50 & -80 & 0 & 0 & 1 & 0 \end{array} \right] \end{array}$$

↑

pivot column

All row operations can be found by pressing [2nd][MATRX] (TI-83+/84) or [MATRX] (TI-83) and scrolling to [Edit].

Row Operation

TI-83/84

Result

(a) $\frac{1}{2}R_1 \rightarrow R_1$

*row(1/2,ANS,1)

$$\begin{array}{c} x_1 \quad x_2 \quad s_1 \quad s_2 \quad P \\ s_1 \left[\begin{array}{cccccc} 0.5 & 1 & 0.5 & 0 & 0 & 16 \end{array} \right] \\ s_2 \left[\begin{array}{cccccc} 3 & 4 & 0 & 1 & 0 & 84 \end{array} \right] \\ P \left[\begin{array}{cccccc} -50 & -80 & 0 & 0 & 1 & 0 \end{array} \right] \end{array}$$

Row Operation

TI-83/84

Result

(b) $(-4)R_1 + R_2 \rightarrow R_2$
 $(80)R_1 + R_3 \rightarrow R_3$

*row + (-4, ANS, 1, 2)

*row + (80, ANS, 1, 3)

$$\begin{array}{c} x_1 \quad x_2 \quad s_1 \quad s_2 \quad P \\ x_2 \left[\begin{array}{cccccc} 0.5 & 1 & 0.5 & 0 & 0 & 16 \end{array} \right] \\ s_2 \left[\begin{array}{cccccc} 1 & 0 & -2 & 1 & 0 & 20 \end{array} \right] \\ P \left[\begin{array}{cccccc} -10 & 0 & 40 & 0 & 1 & 1280 \end{array} \right] \end{array}$$

6) There are still negative numbers in the last row so we must do another pivot operation:

Row Operation

TI-83/84

Result

(a) $(-\frac{1}{2})R_2 + R_1 \rightarrow R_1$
 $(10)R_2 + R_3 \rightarrow R_3$

*row + (-0.5, ANS, 2, 1)

*row + (10, ANS, 2, 3)

$$\begin{array}{c} x_1 \quad x_2 \quad s_1 \quad s_2 \quad P \\ x_2 \left[\begin{array}{cccccc} 0 & 1 & 1.5 & -0.5 & 0 & 6 \end{array} \right] \\ x_1 \left[\begin{array}{cccccc} 1 & 0 & -2 & 1 & 0 & 20 \end{array} \right] \\ P \left[\begin{array}{cccccc} 0 & 0 & 20 & 10 & 1 & 1480 \end{array} \right] \end{array}$$

There are no negative numbers in the last row.

The maximum is 1480 at $x_1 = 20$, $x_2 = 6$, $s_1 = 0$, $s_2 = 0$.