Applied Mathematics I

Chapter 5 #3

Vance Turnewitsch

Use the simplex method to solve the following linear program:

We change: $x_1 = x$, $x_2 = y$, $x_3 = z$

Maximize: $f(x, y, z) = x + y + 3z$

Subject to: $x + z = 1$, $y + z = 2$, $x, y, z \geq 0$

Let P be the function we want to maximize: $P = x + y + 3z \to 0 = P - x - y - 3z$

Thus we have the following system:

$$\begin{gathered} 0 + x + 0 + z = 1 \\ 0 + 0 + y + z = 2 \\ P - x - y - 3x = 0 \end{gathered}$$

Which is the matrix: $\begin{pmatrix} 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 2 \\ 1 & -1 & -1 & -3 & 0 \end{pmatrix}$ $1/1 = 1, 2/1 = 2$, So Pivot about $m_{1,4}$

$\begin{matrix} 3R_1 + R_3 \\ -R_1 + R_2 \end{matrix} \to \begin{pmatrix} 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 2 & -1 & 0 & 3 \end{pmatrix}$ $0/1 = 0, 1/1 = 1$, So Pivot about $m_{2,3}$

$R_2 + R_3 \to \begin{pmatrix} 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 2 & 0 & 0 & 4 \end{pmatrix}$ And we are done!

We see we have a basic variable: $P = 4$