Suppose we have a minimization problem

min $z = c_1x_1 + c_2x_2 + c_3x_3 + \dots + c_nx_n$

subject to some conditions.

Then we can recast it as maximization problem as.

maximize $z' = -c_1x_1 - c_2x_2 - \dots - c_nx_n$

subject to same conditions.

A NEW PROBLEM.

Suppose we have a problem:

maximize $z = 3x_1 + 2x_2 + 5x_3$

subject to $2x_1 - 3x_2 \leq 3$

$4x_1 + 2x_2 - 4x_3 \geq 5$

$2x_1 \quad + 3x_3 \leq 2$

$x_1, x_2 \geq 0$ and x_3 is unrestricted.

Reduce the problem to standard form.

Before proceeding to solution we note that x_3 is unrestricted in sign. But all the problems we have done before all the variables ~~x3o~~ were greater than 0 i.e. all the variable satisfy non negativity condition. In this case we can reformulate the problem ~~by~~ to have all variables satisfying nonnegativity condition.

Solution: ~~First we~~ Since x_3 is unrestricted in sign so we replace x_3 by $x_3 = x_3' - x_3''$ where $x_3', x_3'' \geq 0$ so x_3', x_3'' satisfy non negativity condition.

[When $x_3' \geq x_3''$ we have $x_3 \geq 0$
When $x_3'' \geq x_3'$ we have $x_3 \leq 0$
so we can have unrestricted x_3]

We reformulate the problem as.

maximize $z = 3x_1 + 2x_2 + 5(x_3' - x_3'')$
$= 3x_1 + 2x_2 + 5x_3' - 5x_3''$

subject to
$$2x_1 - 3x_2 \leq 3$$
$$4x_1 + 2x_2 - 4x_3' + 4x_3'' \geq 5$$
$$2x_1 + 3x_3' - 3x_3'' \leq 2$$
~~$x_1, x_2 \geq 0$ and x_3~~ $x_1, x_2, x_3', x_3'' \geq 0$

Now introducing slack and surplus variable we can write in standard form as..

maximize $z = 3x_1 + 2x_2 + 5x_3' - 5x_3'' + 0.x_4 + 0.x_5 + 0.x_6$

subject to
$$2x_1 - 3x_2 + x_4 = 3$$
$$4x_1 + 2x_2 - 4x_3' + 4x_3'' - x_5 = 5$$
$$2x_1 + 3x_3' - 3x_3'' + x_6 = 2$$
$$x_1, x_2, x_3', x_3'', x_4, x_5, x_6 \geq 0$$

x_4, x_6 slack variable, x_5 surplus variable

Scanned with CamScanner