Solution: The given problem can be written as (20)

Maximization $Z = 5x_1 - 2x_2 + 3x_3$

Subject to $-2x_1 - 2x_2 + x_3 \leq -2$

$3x_1 - 4x_2 \leq 3$

$x_2 + 3x_3 \leq 5$

$x_1, x_2, x_3 \geq 0.$

The associated dual is given by

Minimize $W = -2y_1 + 3y_2 + 5y_3$

Subject to $-2y_1 + 3y_2 \geq 5$

$-2y_1 - 4y_2 + y_3 \geq -2$

$y_1 + 3y_3 \geq 3$

y_1, y_2 and $y_3 \geq 0.$

The solution of the dual by Simplex method consists of the following steps.

Step 1: Express the problem in standard form.

Multiplying the second constraint by -1, it can be written as

$2y_1 + 4y_2 - y_3 \leq 2$

Introducing the slack and surplus variables, we get an artificial system given by

minimize $W = -2y_1 + 3y_2 + 5y_3 + 0s_1 + 0s_2 + 0s_3 + MA_1 + MA_2$

Subject to $-2y_1 + 3y_2 - s_1 + A_1 = 5$ $y_1 + 3y_3 - s_3 + A_2 = 3$