2) Construct the dual of the problem

Minimize $Z = 3x_1 - 2x_2 + 4x_3$ (17)

Subject to the Constraints $3x_1 + 5x_2 + 4x_3 \geq 7$

$6x_1 + x_2 + 3x_3 \geq 4$

$7x_1 - 2x_2 - x_3 \leq 10$

$x_1 - 2x_2 + 5x_3 \geq 3$

$4x_1 + 7x_2 - 2x_3 \geq 2$

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

Sol: As the given problem is of Minimization, all Constraints should be of $\geq$ type. Multiplying the third Constraint by -1 on both sides, we get

$$-7x_1 + 2x_2 + x_3 \geq -10.$$

∴ The dual of the given problem will be

Maximize $W = 7y_1 + 4y_2 - 10y_3 + 3y_4 + 2y_5$

Subject to the Constraints

$$3y_1 + 6y_2 + 7y_3 + y_4 + 4y_5 \leq 3$$

$$5y_1 + y_2 - 2y_3 - 2y_4 + 7y_5 \leq -2$$

$$4y_1 + 3y_2 - y_3 + 5y_4 - 2y_5 \leq 4$$

where y_1, y_2, y_3, y_4 and $y_5 \geq 0$.

Here y_1, y_2, y_3, y_4 and y_5 are the dual variables in the 1st, 2nd, 3rd, 4th and 5th Constraints respectively.