

ASSIGNMENT-11

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1 QUESTION No-2.55(INEQUALITIES)

Solve: $3x-4y \leq 60$, $x+3y \leq 30$, $x \geq 0$, $y \geq 0$

2 SOLUTION

From the given inequalities we have,

$$\begin{pmatrix} -3 & -4 \\ -1 & -3 \\ 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -60 \\ -30 \\ 0 \\ 0 \end{pmatrix} \quad (2.0.1)$$

Which can be further written as

$$\begin{pmatrix} -3 & -4 \\ -1 & -3 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -60 \\ -30 \end{pmatrix} \quad (2.0.2)$$

Let $u_1 \geq 0, u_2 \geq 0$. This may be expressed as

$$\mathbf{u} = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} \geq \mathbf{0} \quad (2.0.3)$$

Now we have,

$$\begin{pmatrix} -3 & -4 \\ -1 & -3 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -60 \\ -30 \end{pmatrix} + \mathbf{u} \quad (2.0.4)$$

$$\mathbf{x} = \begin{pmatrix} -3 & -4 \\ -1 & -3 \end{pmatrix}^{-1} \begin{pmatrix} -60 \\ -30 \end{pmatrix} + \begin{pmatrix} -3 & -4 \\ -1 & -3 \end{pmatrix}^{-1} \mathbf{u} \quad (2.0.5)$$

$$\Rightarrow \mathbf{x} = \frac{1}{5} \begin{pmatrix} 60 \\ 30 \end{pmatrix} + \frac{1}{5} \begin{pmatrix} -3 & 4 \\ 1 & -3 \end{pmatrix} \mathbf{u} \quad (2.0.6)$$

$$\mathbf{x} = \begin{pmatrix} 12 \\ 6 \end{pmatrix} + \frac{1}{5} \begin{pmatrix} -3 & 4 \\ 1 & -3 \end{pmatrix} \mathbf{u} \quad (2.0.7)$$

Thus the solution of the system of inequalities can be determined graphically. Which is represented in the below figure,

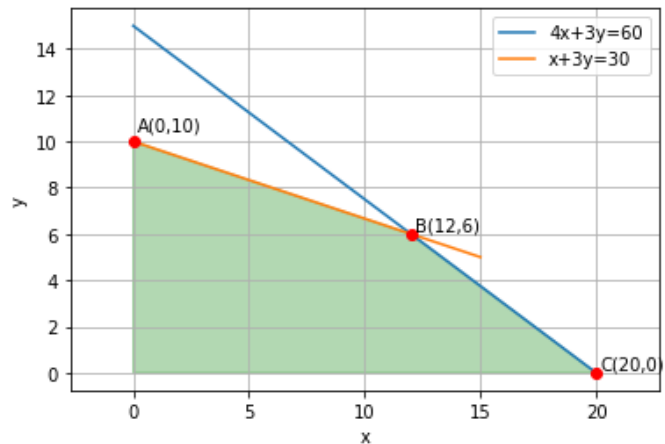


Fig. 2.1: Graphical solution