

Assignment No.6

Valli Devi Bolla

Download all python codes from

<https://github.com/Vallidevibolla/Assignment-6/blob/main/code.py>

and latex-tikz codes from

<https://github.com/Vallidevibolla/Assignment-6/blob/main/main.tex>

Question taken from

https://github.com/gadepall/ncert/blob/main/linalg/quadratic_forms/gvv_ncert_quadratic_forms.pdf—Q.no.2.7

1 QUESTION 2.4

Solve the following system of inequalities graphically.

$$x + 2y \leq 8 \quad (1.0.1)$$

$$2x + y \leq 8 \quad (1.0.2)$$

$$x \geq 0, y \geq 0 \quad (1.0.3)$$

2 SOLUTION

From the given inequalities we have,

$$\begin{pmatrix} -1 & -2 \\ -2 & -1 \\ 1 & 0 \\ 0 & 1 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -8 \\ -8 \\ 0 \\ 0 \end{pmatrix} \quad (2.0.1)$$

Which can be further written as

$$\begin{pmatrix} -1 & -2 \\ -2 & -1 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -8 \\ -8 \end{pmatrix} \quad (2.0.2)$$

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,

$$\begin{pmatrix} -1 & -2 \\ -2 & -1 \end{pmatrix} \mathbf{x} \geq \begin{pmatrix} -8 \\ -8 \end{pmatrix} + \mathbf{u} \quad (2.0.4)$$

$$\mathbf{x} = \begin{pmatrix} -1 & -2 \\ -2 & -1 \end{pmatrix}^{-1} \begin{pmatrix} -8 \\ -8 \end{pmatrix} + \begin{pmatrix} -1 & -2 \\ -2 & -1 \end{pmatrix}^{-1} \mathbf{u} \quad (2.0.5)$$

$$\Rightarrow \mathbf{x} = \frac{-1}{3} \begin{pmatrix} 8 \\ 8 \end{pmatrix} + \frac{-1}{3} \begin{pmatrix} -1 & 2 \\ 2 & -1 \end{pmatrix} \mathbf{u} \quad (2.0.6)$$

$$\mathbf{x} = \begin{pmatrix} -\frac{8}{3} \\ -\frac{8}{3} \end{pmatrix} + \frac{-1}{3} \begin{pmatrix} -1 & 2 \\ 2 & -1 \end{pmatrix} \mathbf{u} \quad (2.0.7)$$

Thus the solution of the system of inequalities can be determined graphically, which is represented in Fig.

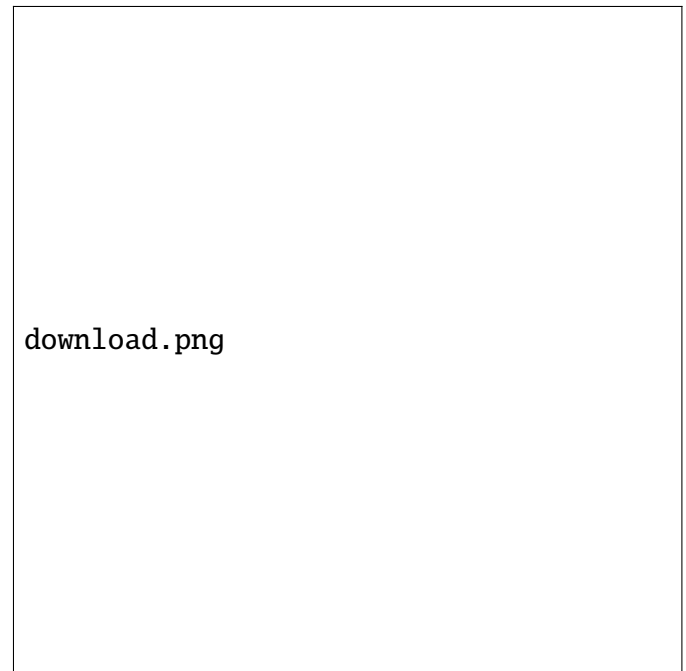


Fig. 0: Graphical solution