Assignment - 7

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***Abstract*—This is a simple document to learn about writing vectors, matrices and quadratic forms using latex, draw figures using Python, Latex.**

Download all python and latex-tikz codes from

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svn co https://github.com/arjunjc93/Assignment-6.git
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1 Inequalities
G V V Sharma
Exercise 2.2

1.1. Solve the following system of inequalities graphically:

$$5x + 4y \le -40 \tag{1.1.1}$$
$$x \ge 2 \tag{1.1.2}$$
$$y \ge 3 \tag{1.1.3}$$

Solution:

a) Solving first pair of inequality:

$$-5x - 4y \ge -40 \tag{1.1.4}$$
$$x \ge 2 \tag{1.1.5}$$

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

$$\mathbf{u} = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix} \ge 0 \tag{1.1.6}$$

The pair of equations can then be expressed as

$$\begin{pmatrix} -5 & -4 \\ 1 & 0 \end{pmatrix} \mathbf{x} \ge \begin{pmatrix} -40 \\ 2 \end{pmatrix} \tag{1.1.7}$$
$$\begin{pmatrix} -5 & -4 \\ 1 & 0 \end{pmatrix} \mathbf{x} - \mathbf{u} = \begin{pmatrix} -40 \\ 2 \end{pmatrix} \tag{1.1.8}$$
$$\begin{pmatrix} -5 & -4 \\ 1 & 0 \end{pmatrix} \mathbf{x} = \begin{pmatrix} -40 \\ 2 \end{pmatrix} + \mathbf{u} \tag{1.1.9}$$
$$\implies \mathbf{x} = \begin{pmatrix} -5 & -4 \\ 1 & 0 \end{pmatrix}^{-1} \begin{pmatrix} -40 \\ 2 \end{pmatrix} + \begin{pmatrix} -5 & -4 \\ 1 & 0 \end{pmatrix}^{-1} \mathbf{u} \tag{1.1.10}$$
$$\mathbf{x} = \begin{pmatrix} 2 \\ \frac{15}{2} \end{pmatrix} + \begin{pmatrix} 0 & -1 \\ \frac{-1}{4} & \frac{-5}{4} \end{pmatrix} \tag{1.1.11}$$

b) Solving second pair of inequality:

$$-5x - 4y \ge -40 \tag{1.1.12}$$
$$y \ge 3 \tag{1.1.13}$$

The pair of equations can then be expressed as

$$\begin{pmatrix} -5 & -4 \\ 0 & 1 \end{pmatrix} \mathbf{x} \ge \begin{pmatrix} -40 \\ 3 \end{pmatrix} \tag{1.1.14}$$
$$\begin{pmatrix} -5 & -4 \\ 0 & 1 \end{pmatrix} \mathbf{x} - \mathbf{u} = \begin{pmatrix} -40 \\ 3 \end{pmatrix} \tag{1.1.15}$$
$$\begin{pmatrix} -5 & -4 \\ 0 & 1 \end{pmatrix} \mathbf{x} = \begin{pmatrix} -40 \\ 3 \end{pmatrix} + \mathbf{u} \tag{1.1.16}$$
$$\implies \mathbf{x} = \begin{pmatrix} -5 & -4 \\ 0 & 1 \end{pmatrix}^{-1} \begin{pmatrix} -40 \\ 3 \end{pmatrix} + \begin{pmatrix} -5 & -4 \\ 0 & 1 \end{pmatrix}^{-1} \mathbf{u} \tag{1.1.17}$$
$$\mathbf{x} = \begin{pmatrix} \frac{28}{5} \\ 3 \end{pmatrix} + \begin{pmatrix} -\frac{1}{5} & \frac{-4}{5} \\ 0 & 1 \end{pmatrix} \tag{1.1.18}$$

From (1.1.11) & (1.1.18) solution of the given system of inequalities can be found out graphically by intersection as shown in Figure 1.

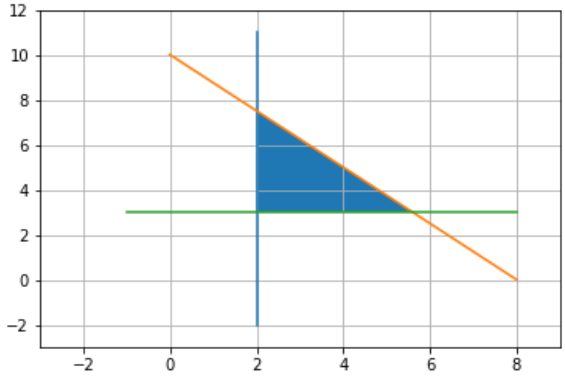

Fig. 1.1. Figure 1