Notation

Note Title 2/22/2011

$ax \leq b \qquad ax = b$

$$\underset{1\times n}{\begin{bmatrix} a_1 & \cdots & a_n \end{bmatrix}} \underset{n\times 1}{\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}} \leq b$$

$a_1, \ldots, a_n, b \in \mathbb{Q}$

$x_1, \ldots, x_n \in \mathbb{R}$

$$\sum_{i=1}^{n} a_i x_i \leq b$$

$Ax \leq b \qquad Ax = b$

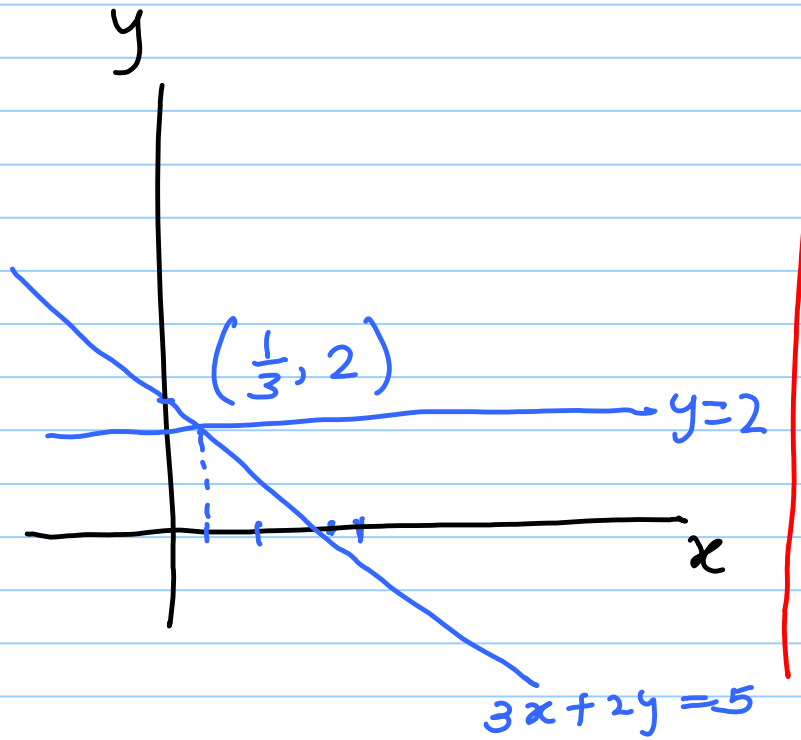
$$\underset{m\times n}{\begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & & \\ a_{m1} & \cdots & a_{mn} \end{bmatrix}} \underset{n\times 1}{\begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix}} \leq \underset{m\times 1}{\begin{bmatrix} b_1 \\ \vdots \\ b_m \end{bmatrix}}$$

$$\bigwedge_{i=1}^{m} \left(\sum_{j=1}^{n} a_{ij} x_j \leq b_i \right)$$

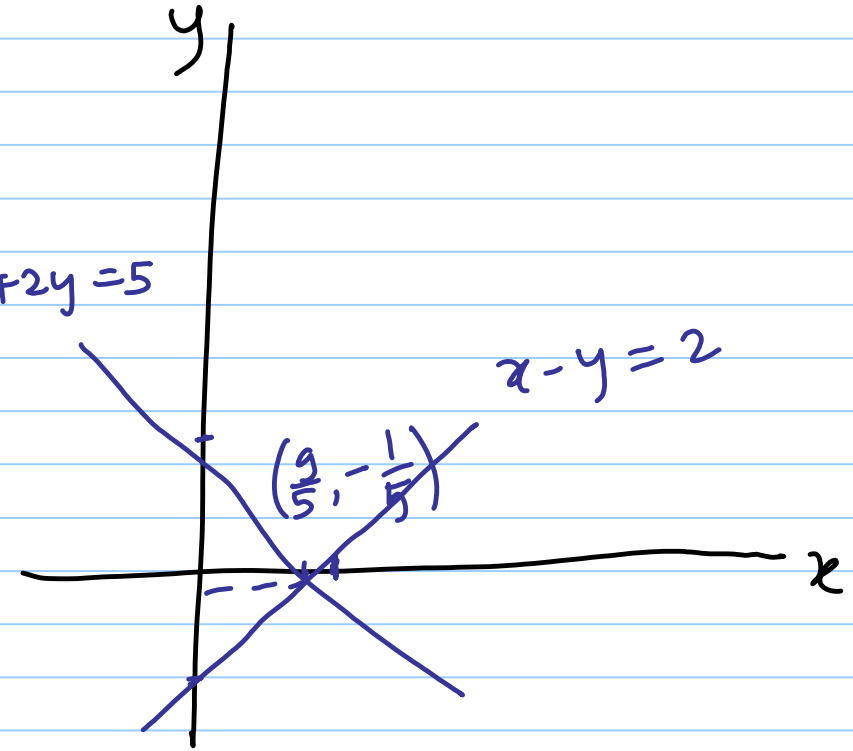
Simultaneous Linear Equations

Note Title 2/19/2011

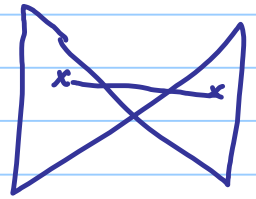
Example I. $3x+2y=5$, $y=2$

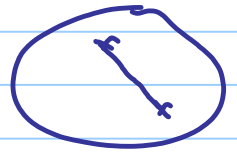


Example II. $3x+2y=5$, $x-y=2$



Convex Sets





Convex Polyhedra

Convex polyhedron: Intersection of half-spaces

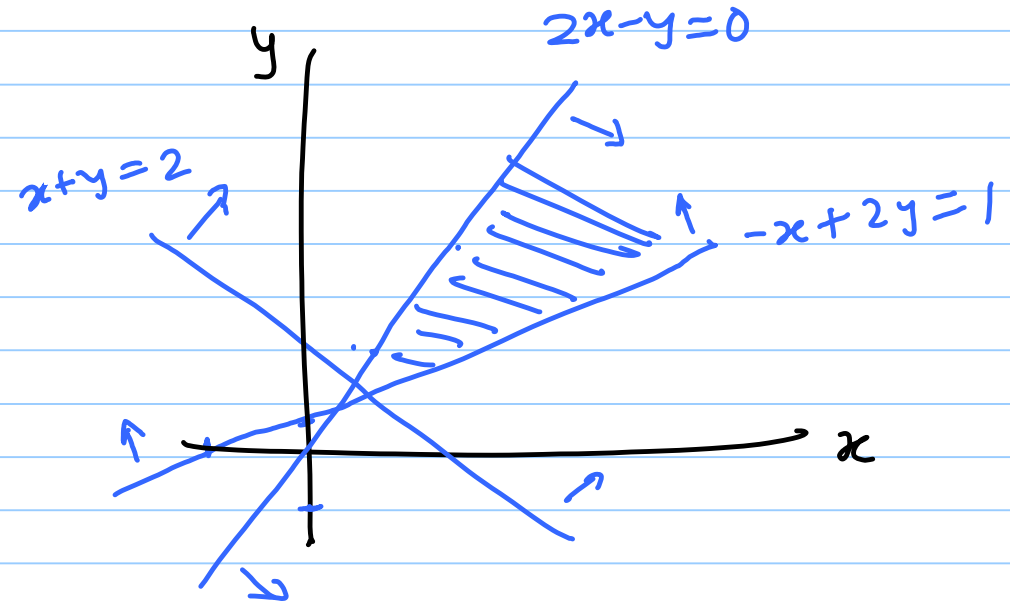
Half-space: Inequality of the form $a_1x_1 + \cdots + a_nx_n \leq b_n$

Example III.

$$x + y \geq 2$$

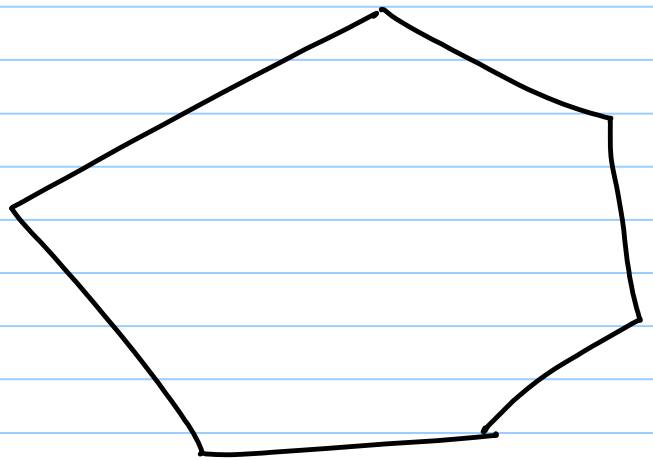
$$2x - y \geq 0$$

$$-x + 2y \geq 1$$



Linear Programming

maximize $\vec{c}\vec{x}$ s.t. $A\vec{x} \leq \vec{b}$, $\vec{x} \geq \vec{0}$



Optimal solution if it exists, is always found at a corner/edge.

Simplex (for optimization)

1. Find a corner of the polyhedron
2. Walk along an adjacent edge to a max corner, if possible

Feasibility of System of Inequalities

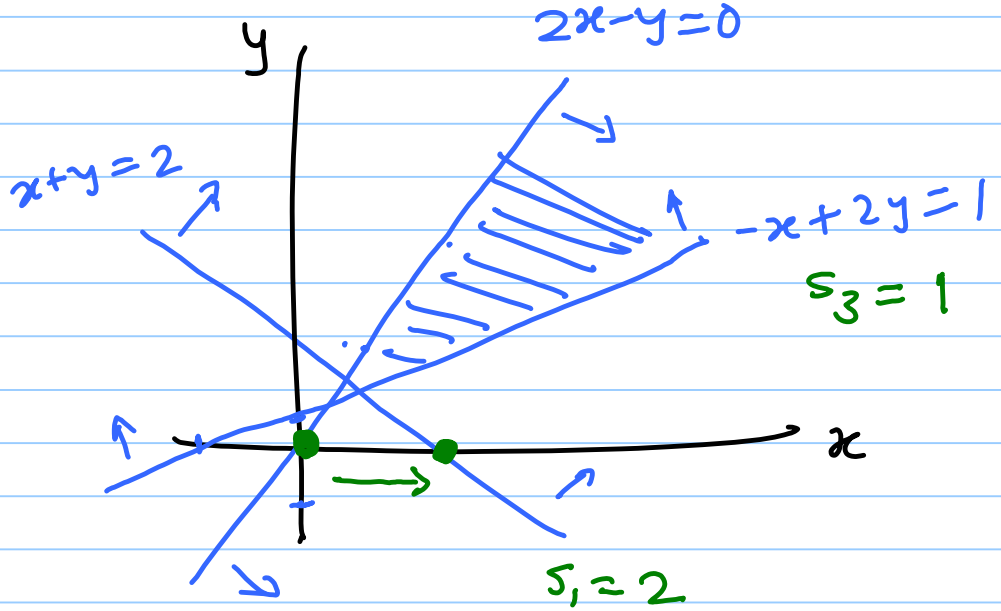
≡ Find a corner of the convex polyhedron

$x+y \geq 2$ s_1

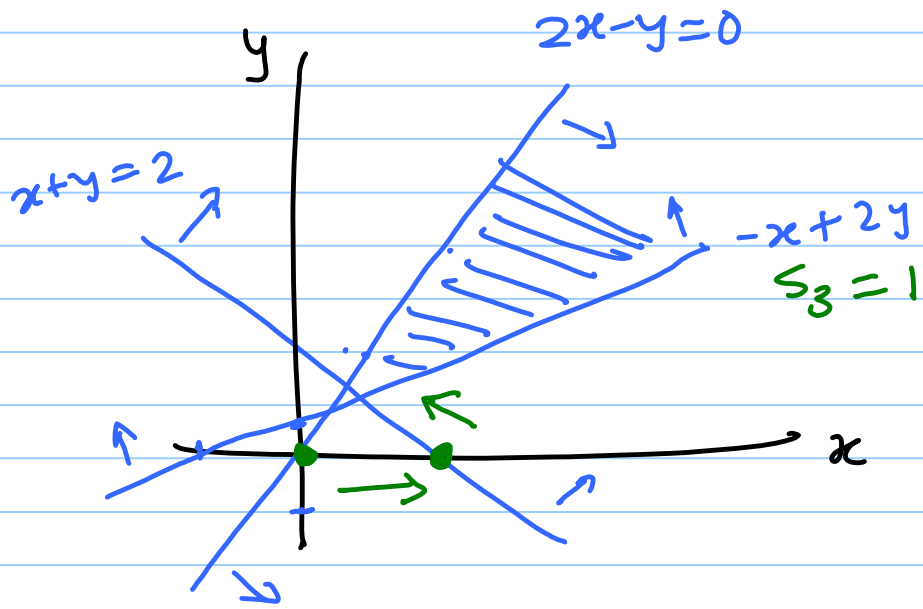
$2x-y \geq 0$ s_2

$-x+2y \geq 1$ s_3

Step I. $x=0$ $y=0$



Step II. $x=2$ $y=0$



Step III. $x=1$ $y=1$