CSDS 440: Assignment 4

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Problem 16

Pick two points, x_1 and x_2 in R^n where $Ax_1, Ax_2 \geq b$. W.T.S. for any point x between the line of x_1 and x_2, we have $Ax \geq b$.

$$\begin{aligned} Ax &= A(\lambda x_1 + (1-\lambda)x_2) \\ &= \lambda Ax_1 + (1-\lambda)Ax_2 \\ &\geq \lambda b + (1-\lambda)b = \lambda b + b\lambda b = b \\ \implies Ax &\geq b \end{aligned}$$

As x in above case can be any point from of $\{x \mid Ax \geq b\}$, we have proven the set is convex.