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MA 26500 Quiz 6

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1. Consider the matrix

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 3 & 3 \\ 0 & -1 & -1 \end{bmatrix}. \qquad (\star)$$

(a) (12 points) Recall that the **nullspace** of an $m \times n$ matrix A is the set of vectors $\mathbf{x}$ in $\mathbb{R}^m$ such that $A\mathbf{x} = \mathbf{0}$. This subset spans a subspace of $\mathbb{R}^m$. Give a description of the nullspace of the matrix $(\star)$ by writing down basis for the nullspace.

[HINT: You should begin by putting the matrix in rref.]

(b) (8 points) The **range** or **columnspace** of an $m \times n$ matrix A is the set of vectors $\mathbf{y}$ in $\mathbb{R}^n$ that are, in some sense, "hit" by vectors $\mathbf{x}$ in $\mathbb{R}^n$ by the matrix A, i.e., $\mathbf{y} = A\mathbf{x}$ for some $\mathbf{x}$. Using your calculations from above (the hint), write down a basis for the range of $(\star)$.