MAS 3105 (LINEAR ALGEBRA)
Assignment 2, due Wednesday June 08, 2016

Name: **PID:**

Remember that you won't get any credit if you do not show the steps to your answers. Neither me nor the LA can help you with this assignment, as it is graded. Assignments written the same way will all get zero. No late assignment will be accepted.

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1. For which values of the parameter m are the vectors $\mathbf{u}_1 = (1, m, 3)^T$, $\mathbf{u}_2 = (2, -1, 4)^T$ and $\mathbf{u}_3 = (m, -2, 1)^T$ linearly independent?

2) In $\mathbb{R}^4$, consider the vectors $\mathbf{v}_1 = (1, 2, -1, m-2)^T$, $\mathbf{v}_2 = (2, 1, m+1, -4)^T$, $\mathbf{v}_3 = (-3, m-1, 2, 2)^T$, $\mathbf{v}_4 = (-2, 1, -3, 4)^T$. Find all real numbers m such that $\mathbb{R}^4 = \text{Span}(\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3, \mathbf{v}_4)$.

3) Let $\mathbf{u}_1 = (1, 3, 1)^T$, $\mathbf{u}_2 = (-1, 2, 1)^T$, $\mathbf{u}_3 = (3, 2, -2)^T$ be vectors in $\mathbb{R}^3$. Consider the vectors $\mathbf{v}_1 = (-1, -1, 3)^T$, $\mathbf{v}_2 = (1, 1, 4)^T$, $\mathbf{v}_3 = (-4, 1, 3)^T$.

   a) Show that $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$ and $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ are bases of $\mathbb{R}^3$.

   b) Find the transition matrix from the ordered basis $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ to the ordered basis $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$.

   c) If $\mathbf{v} = 3\mathbf{v}_1 - 2\mathbf{v}_2 + \mathbf{v}_3$, find the coordinates of $\mathbf{v}$ in the ordered basis $\{\mathbf{u}_1, \mathbf{u}_2, \mathbf{u}_3\}$.

4) Let A be a 3×3 matrix with $A^3 = \mathbf{0}_{\mathcal{M}_3}$, but $A^2 \neq \mathbf{0}_{\mathcal{M}_3}$. Let $x \in \mathbb{R}^3$ such that $A^2x \neq \mathbf{0}_{\mathbb{R}^3}$. Show that the vectors x, Ax and A^2x are linearly independent. Can they form a basis of $\mathbb{R}^3$? Explain.