Honors Linear Algebra (Spring 2011) — Homework 5

- DL-LAA stands for the text (David Lay – Linear Algebra and its Applications).

- Problems marked with [**M**] involve the use of MATLAB. You must submit the commands you use as well as all output from MATLAB as part of the answer to such a problem.

  You are welcome to email me these commands and output files. If you do email me, name the file(s) using your first and last names. For instance, if you are Eric Cartman and are sending me a text file, you could name it something like `MatlabHw4_Eric_Cartman.txt`.

- The points for each problem is given in parentheses. The total points add up to 75. You will be graded for 70 points, with the possibility of getting up to 5 points as extra credit.

- **This homework is due in class on Thursday, February 17**.

1. (4)   DL-LAA Problem 19 from page 71.

2. (4)   DL-LAA Problem 20 from page 71.

3. (12)   DL-LAA Problem 22 from page 71.

4. (8)   DL-LAA Problem 26 from page 71.

5. (6)   DL-LAA Problem 39 from page 72.

6. (13)   DL-LAA Problem 26 from page 81.

7. (10)   Show that the transformation $T : \mathbb{R}^2 \to \mathbb{R}^3$ defined by

$$T(x_1, x_2) = (x_1^2 + x_2,\ 3x_1 - 2,\ -x_2) \text{ is not linear.}$$

8. (18)   [**M**] The command `rand(m,n)` in Matlab generates an $m \times n$ matrix with real entries chosen randomly between 0 and 1.

   (a) Generate a 4×6 matrix A with entries chosen randomly between 0 and **10** in Matlab. (*Hint:* First generate a matrix with entries chosen randomly between 0 and 1, and then multiply the entire matrix by 10.)

   (b) With $\mathbf{a}_j$ denoting the jth column of A, create a matrix B consisting of columns $\mathbf{a}_2, \mathbf{a}_5, \mathbf{a}_1, \mathbf{a}_4, \mathbf{a}_6, \mathbf{a}_3$ of A, *in that order*.

   (c) Find the reduced echelon forms of A and B using `rref`. Call them C and D, respectively. Are the two reduced echelon forms the same?

   (d) With $\mathbf{c}_j$ denoting the jth column of C, form the matrix E made of the columns $\mathbf{c}_2, \mathbf{c}_5, \mathbf{c}_1, \mathbf{c}_4, \mathbf{c}_6, \mathbf{c}_3$ of C, *in that order*.

   (e) Are E and D the same? If not, how can you transform E to get D?