HOMEWORK 11
DUE WEDNESDAY, 9 APRIL 2008

MATH 215 - LINEAR ALGEBRA - TOM LAGATTA

- Read pages 189-223 in the textbook (Sections 3.5 and 3.6).

- After last exam, I am convinced that all of you are experts at Gaussian elimination. From now on, you may use technology to row reduce matrices on the homework. Don't get too rusty, though, as you'll need to row reduce by hand for Exam 3 and the Final Exam!

- I taught you one technique for finding a basis for $\text{col}(A)$ in class. Here is another one: since $\text{col}(A) = \text{row}(A^T)$, we can row reduce A^T and take as a basis its nonzero rows. This basis will be typically different than when using the technique from class. You will need this for problems 21, 22, 25.

- **Section 3.5:** 17, 18, 20, 21, 22, 25, 27, 28, 35, 36, 38, 39, 40, 41, 42, 45, 46, 55, 57, 59

- (Problem A) Theorem 3.23 (The Basis Theorem) is an important theorem, because it says that the mathematical definition of dimension coincides with our intuitive one. I didn't prove it in class because the notation is quite obnoxious. For this homework problem, mimick the proof in the book to prove that if $\mathcal{B} = \{\vec{u}_1, \vec{u}_2\}$ is a basis for $\mathcal{S}$ and $\mathcal{C} = \{\vec{v}_1, \vec{v}_2, \vec{v}_3\}$ spans $\mathcal{S}$, then $\mathcal{C}$ is linearly dependent.

  That is, suppose that $c_1\vec{v}_1 + c_2\vec{v}_2 + c_3\vec{v}_3 = \vec{0}$, and use the arguments in the book to show that there is a nontrivial solution dependence relation.

(continued on next page)

Date: Spring 2008.

- **MATLAB:** For the following problems, you will need to download the scripts `line3d.m` and `plane3d.m` from my webpage. In MATLAB, make sure that the "Current Directory" has these two files in it. Please include your figures with your homework assignment, and clearly indicate what problems they are for.
  (1) In the same figure, plot the line spanned by $u = [1\ 2\ 3]$ and the plane spanned by $v = [4\ -2\ 1]$ and $w = [-1\ 1\ 0]$ by typing:

  `line3d(u)`

  and

  `plane3d(v,w)`

  Using the magnifying glass and the rotate button (both next to the hand on the toolbar), play around until you get a good view. Print and save your figure, then close it before you move onto the next problem.
  (2) In Exercise 17, you found bases for $\text{row}(A)$ and $\text{null}(A)$ in $\mathbb{R}^3$. Plot the plane $\text{row}(A)$ and the line $\text{null}(A)$ in the same figure. What is $\text{col}(A)$, and why haven't I asked you to plot it?
  (3) In Exercise 20, you found a basis for $\text{col}(A)$ in $\mathbb{R}^3$. If $\text{col}(A)$ is a plane or line, plot it. Explain why you can't plot $\text{row}(A)$ or $\text{null}(A)$.