Name _____ Class Time _____

Math 2270 Extra Credit Problems
Chapter 2
December 2011

These problems were created for Bretscher's textbook, but apply for Strang's book, except for the division by chapter. To find the background for a problem, consult Bretscher's textbook, which can be checked out from the math library or the LCB Math Center.

Due date: See the internet due dates. Records are locked on that date and only corrected, never appended.

Submitted work. Please submit one stapled package. Kindly label problems **Extra Credit**. Label each problem with its corresponding problem number. You may attach this printed sheet to simplify your work.

Problem XC2.1-16. (**Invertible** T)

Decide invertibility of $T(\mathbf{x}) = A\mathbf{x}$ for the following matrices A. Then find the matrix of T^{-1}, in each case.

$$\begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}, \quad \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}, \quad \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix}.$$

Problem XC2.1-43. (**Matrix of** T)

(a) Suppose $\mathbf{v}$ has components 2, -2, 5. Find the matrix of $T(\mathbf{x}) = \mathbf{v} \cdot \mathbf{x}$.
(b) Prove that every linear transformation T from $\mathcal{R}^3$ into $\mathcal{R}^1$ can be written as $T(\mathbf{x}) = \mathbf{v} \cdot \mathbf{x}$ for some vector $\mathbf{v}$.

Problem XC2.1-46. (**Matrix of** T)

(a) Let $T(\mathbf{x}) = B(A(\mathbf{x}))$ where

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}.$$

Find the matrix of T.
(b) What is the matrix of T defined by $T(\mathbf{x}) = B^2(A(\mathbf{x}))$?

Problem XC2.2-18. (**Reflection line equation**)

Let a reflection T have matrix $\frac{1}{2}\begin{pmatrix} \sqrt{3} & 1 \\ 1 & -\sqrt{3} \end{pmatrix}$. Find the equation for the line L of reflection.

Problem XC2.2-26. (**Matrix of** T)

(a) Find the scaling matrix A if $T\left(\begin{pmatrix} 2 \\ -1 \end{pmatrix}\right) = \begin{pmatrix} 8 \\ -4 \end{pmatrix}$.
(b) Find the projection matrix A if $T\left(\begin{pmatrix} 2 \\ 3 \end{pmatrix}\right) = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

Problem XC2.2-39. (**Composite linear transformations**)

Each of the matrices below is a standard geometric linear transformation followed by a scaling. Find the scale factor.

$$\begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix}, \quad \begin{pmatrix} 6 & 0 \\ -2 & 6 \end{pmatrix}, \quad \begin{pmatrix} 3/4 & 1 \\ 1 & -3/4 \end{pmatrix}.$$

End of extra credit problems chapter 2.