

MATH 3110 - Fall 2015

Homework 3

Due: Thursday September 17

ALWAYS MOTIVATE THE ANSWERS!

Questions. Chapter 3 of Strang

(total of 6 marks)

- (a) Describe the column space of $A = \begin{pmatrix} 1 & 1 & 0 \\ 0 & -1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$. Which subspace is it? (2 marks)
- (b) Construct a 3×3 matrix whose column space contains vectors $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$, $\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$ and not $\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ (2 marks)
- (c) Construct a 3×3 matrix whose column space is a line. (2 marks)

Questions. Chapter 3 of Strang

(total of 14 marks)

- Prove the following statements about the vector space \mathbb{M} of 3×3 matrices (6 marks)
 - The set of upper triangular matrices is a subspace of \mathbb{M} .
 - The union of the following sets
 - upper triangular matrices of \mathbb{M} , and
 - lower triangular matrices of \mathbb{M}is *not* a vector space of \mathbb{M} . (Find an example.)
 - The set of symmetric matrices is a subspace of \mathcal{M}
- Compute the row reduced echelon form of the following matrices (3 marks)

$$A = \begin{pmatrix} 1 & 2 & 2 & 3 & 9 \\ 3 & 6 & 1 & 4 & 7 \\ 0 & 0 & 1 & 1 & 4 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 2 & 3 & 3 \\ 4 & 1 & 1 \\ 1 & 2 & 3 \end{pmatrix}$$

- Find the special solutions of the nullspace of the following matrices (3 marks)

$$A = \begin{pmatrix} 1 & 0 & 3 & 5 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 0 & 0 \end{pmatrix} \text{ and } B = \begin{pmatrix} 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{pmatrix}.$$

- Construct a matrix A such that $N(A)$ contains all multiples of $\begin{pmatrix} 0 \\ 1 \\ 2 \\ 1 \end{pmatrix}$. (2 marks)