MATH 3110 - Fall 2015
Homework 5

Due: Thursday October 1

Questions. Chapter 3.6 of Strang **(total of 8 marks)**

1. Compute dimension and basis of the four fundamental subspaces of the matrix (8 marks)

$$A = \begin{pmatrix} 1 & 2 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ -1 & -1 & 2 & 1 & 1 \end{pmatrix}.$$

Questions. Chapter 4.1 of Strang **(total of 12 marks)**

1. Find dimension and basis of the orthogonal complement $S^{\perp} \subset \mathbb{R}^3$ when (4 marks)

(a) $S = \langle \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \rangle$ (b) $S = \langle \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} -3 \\ -2 \\ -1 \end{pmatrix} \rangle$

2. Let $P \subseteq \mathbb{R}^4$ be the plane defined the linear equation $x_1 + 2x_2 + 3x_3 + 4x_4 = 0$. (2 marks)
Write a basis for $P^{\perp}$ and construct a matrix that has P as nullspace. (HINT: write this equation in the form $Ax = 0$.)
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3. For each of the following sentences, solve it or motivate if unsolvable. (6 marks)

   (a) Find a matrix with $(1, 4, 2)$ in both its row space and column space.

   (b) Find a matrix with $(1, 4, 2)$ in both its row space and nullspace.

   (c) Find a matrix with $(1, 4, 2)$ in both its column space and nullspace.