Multiple View Geometry: Exercise Sheet 1

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Part I: Theory

The following exercises have to be **solved at home**. You will present your answer during the tutorials.

1. Show for each of the following sets (1) whether they are linearly independent, (2) whether they span $\mathbb{R}^3$ and (3) whether they form a basis of $\mathbb{R}^3$:

   - $B_1 = \left\{ \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \right\}$
   - $B_2 = \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \right\}$
   - $B_3 = \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \right\}$

2. Which of the following sets forms a group (with matrix-multiplication)? Prove or disprove!

   - $G_1 := \left\{ A \in \mathbb{R}^{n \times n} | \; det(A) \neq 0 \wedge A^T = A \right\}$
   - $G_2 := \{ A \in \mathbb{R}^{n \times n} | \; det(A) = -1 \}$
   - $G_3 := \{ A \in \mathbb{R}^{n \times n} | \; det(A) > 0 \}$

3. Prove or disprove: There exist non-zero vectors $v_1, \ldots, v_4 \in \mathbb{R}^3 \setminus \mathbf{0}$, which are pairwise orthogonal (i.e., $\forall i, j : \langle v_i, v_j \rangle = 0$).

Part II: Practical Exercises

In this tutorial we will give a quick Matlab introduction.

Matlab-Tutorials:
http://www.math.utah.edu/lab/ms/matlab/matlab.html
http://www.math.ufl.edu/help/matlab-tutorial/