

**CSE 494/598, Fall 2007 Homework 1**  
**Due on Wednesday, August 29**

1. Compute the eigenvalues and the eigenvectors of the following matrix:

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

2. Compute the angle between the following two vectors:  $x = (1, 2, 3, 4)$ ,  $y = (4, 3, 2, 1)$ .

3. Let  $x$  be a vector in  $\mathbb{R}^n$ . Show that  $\lim_{p \rightarrow \infty} \|x\|_p = \|x\|_\infty$ .

4. Let  $B$  be any submatrix of  $A$ . Show that  $\|B\|_p \leq \|A\|_p$ .

5. Let  $A \in \mathbb{R}^{m \times r}$  and  $B \in \mathbb{R}^{r \times n}$  be two matrices. Show that  $\text{rank}(AB) \leq \min\{\text{rank}(A), \text{rank}(B)\}$ .